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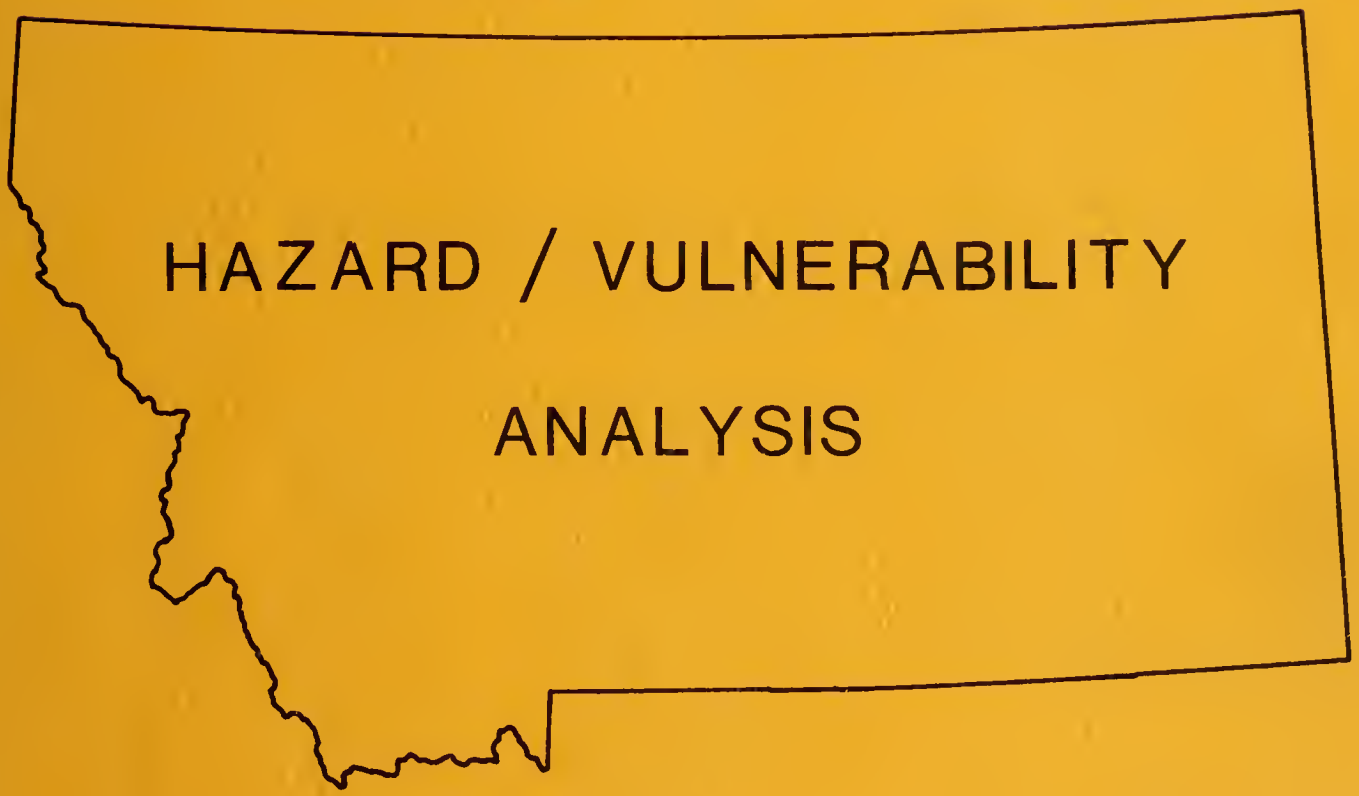

HAZARD / VULNERABILITY ANALYSIS

MONTANA DISASTER PREPAREDNESS PROGRAM

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Montana Disaster Preparedness Program

HAZARD/VULNERABILITY ANALYSIS

July 1976

Prepared by:

Civil Defense Division

Montana Department of Military Affairs

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INTRODUCTION

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MONTANA DISASTER PREPAREDNESS PROGRAM

HAZARD/VULNERABILITY ANALYSIS

INTRODUCTION

This analysis of past and potential hazards effecting Montana is based on historical records of Local, State, and Federal governments and agencies, after-action reports of natural disasters and published studies of specific problem areas. Additionally, the statements of numerous authorities who have experienced disasters first hand have been considered.

The purpose of the study is to identify conditions that State and local authorities and the general public must be prepared to meet. Awareness of potential problems is necessary in order to develop comprehensive plans and to effectively direct preventive and corrective actions.

Economic loss is not always the critical element in determing the need for assistance or the type of help required. An attempt has been made to record and analyze events, natural or man-caused, which result in requests, from Local to State, or State to Federal, for assistance.

It is our intent that this compilation of information will be helpful to State and local jurisdictions in their preparations for:

1. Avoiding or mitigating the effects of disasters,
2. Contending with immediate problems during disasters, and
3. Recovering from their effects in the shortest possible time.

Actions in the first category--mitigation--can have great significance in reducing future loss of life and economic losses. Immediacy is not the essential factor here. During the recovery phase, also, the time element

is not overwhelmingly critical. Being forced to detour around a bridge under repair is inconvenient and increases operating costs, but a family stranded on a bridge isolated by swirling flood water constitutes an urgent humanitarian problem. As this analysis is applied to planning activities the differences in response dictated by these varying conditions deserve consideration.

SUMMARY

SUMMARY

An inventory of past natural disasters reveals that Montana has suffered to varying degrees from almost all disasters except those which are a phenomena of the seacoasts. Though some counties have been hit more frequently than others, no area of the State can claim immunity.

Some disasters are obviously seasonal - winter storms, forest and range fires, droughts - while others, such as earthquakes and transportation accidents may occur without regard to the calendar. Traditionally we have identified the months of late spring with floods, but experience has shown that rivers occasionally leave their banks in mid-winter with disastrous results.

Until disaster prediction develops into a more exact science conclusions from such analysis as this must be general rather than specific. Apparently the unexpected can happen and often does.

Immediately following this summary are two charts depicting disaster effects of various natural disasters in rural and urban situations. The principal variation is in degree of severity resulting from the difference in concentration of people in the two categories. We can expect, then, that as the State's population rises disasters of equal intensity will cause greater problems - more deaths, more injuries, greater disruptions of normal activity, greater economic loss, etc. That is, these undesirable effects will be felt unless counter actions are taken by responsible planners.

Immediately prior to or during a disaster options are limited. Timely warning of potential victims can be very effective in saving lives and reducing losses. Similarly evacuation is a defensive measure at this stage. Results of both can be improved considerably by prior planning.

Planners are not limited in their options in anticipation of future

disasters. The list of planning factors is quite extensive, including such varied measures as zoning to prevent building in hazardous areas, strengthening building codes, improving communication facilities, restricting storage of toxic materials, routing hazardous shipments to avoid heavily populated areas, etc. Legislative revisions may be necessary in some instances in order to implement these actions for public benefit. None of these mitigating factors will reach their potential without a directed effort.

Two deficiencies became apparent as this analysis was developed (1) incomplete records of disasters and their effects and (2) limited research on the entire subject. Where State agencies have specific areas of responsibility relative to disasters planning data is available. There is a need, however, for a central repository of pertinent records and disaster related data on which planners can draw for developing effective disaster response plans.

DISASTER EFFECTS

RURAL

	Death and Injury	Sickness and Disease	Homeless Persons	Food & Clothing Requirement	Unemployment	Structural Damage	Damage to Utilities	Agricultural Disruption	Transportation Problems	Debris & Residue Disposal	Explosions and Fires	Landslides	Livestock & Wildlife
Aircraft Accidents	●								○	○		
Civil Disorders	○											
Drought					○			●			○		○
Earthquakes	○		○	○		○	○	○	○	○	○	○	○
Floods	○	○	○	○	○	○	○	●	○	●		○	○
Forest Fires	○		○		○	○	○	○		○	●		○
Hazardous Material Accidents		○							○	○	○		
Insect Infestation								○					○
Range Fires						○		●			●		○
Tornados	○		○			○	○	○	○	○	○		
Transportation Accidents	●		○					○	○	○			
Wind Damage	○					○	○	○		○	○		
Winter Storms	○			○			○	●	●	○		○	●

● Severe

○ Moderate

○ Low

The above chart depicts effects which can be anticipated under certain assumed conditions or degree of severity of the disasters under consideration. Individuals applying these ratings, should treat them as indicators, only.

DISASTER EFFECTS

URBAN

	Death and Injury	Sickness and Disease	Homeless Persons	Food & Clothing Requirement	Unemployment	Structural Damage	Damage to Utilities	Business Disruption	Transportation Problems	Debris & Residue Disposal	Explosions and Fires	Landslides
Aircraft Accidents	●					○			○	○	●		
Civil Disorders	○	◯				◯	◯	○	◯	◯	○		
Drought				◯	○			◯					
Earthquakes	●	◯	●	●	○	●	●	●	○	●	●	○	
Floods	○	○	○	●	○	●	○	○	○	●	○		
Forest Fires	Normally not a hazard to urban communities except those in close proximity to forested area.												
Hazardous Material Accidents	◯	◯							○	○	○		
Range Fires	Normally not a hazard to urban communities. Exceptions have been recorded.												
Tornados	○		○	○	◯	●	●	●	○	●	○		
Transportation Accidents	○								●	◯	◯		
Wind Damage	○			◯		○	○	◯	○	◯	○		
Winter Storms	◯				◯		○	◯	○	◯	◯		

● Severe

○ Moderate

◯ Low

The above chart depicts effects which can be anticipated under certain assumed conditions or degree of severity of the disasters under consideration. Individuals applying these ratings, should treat them as indicators, only.

SECTION I

CIVIL DISORDERS

CIVIL DISORDERS

Riots

Civil disturbances as defined herein are group acts of violence and disorder prejudicial to public law and order. The term includes all domestic conditions requiring or likely to require augmentation of local law enforcement personnel or the use of auxiliaries such as State and Federal uniformed forces. Confrontations of this type, initially involving the local political sub-division, have become prevalent.

Under the constitution and laws of the United States the protection of life and property and maintenance of law and order within the territorial jurisdiction of the state are the primary responsibility of that state and local jurisdiction.

From time to time the State of Montana has experienced disturbances in certain local jurisdictions of such a magnitude as to require aid beyond available local resources.

In 1957 a prison riot lasting 2 days at the State Prison, Deer Lodge, Montana, required the use of National Guard troops and resources to bring it under control. Again in April 1959 a second prison riot lasting 20 days cost the life of the deputy prison Warden and again brought about the use of National Guard troops in addition to all highway patrol units available beyond daily minimal needs. Several incidents involving prison personnel have been recorded since the above disturbances, but to a lesser degree.

A number of incidents have taken place involving communities or local jurisdictions throughout the State that triggered grave concern

and required mutual aid with considerable planning and resources to effect control.

Annually since 1964, unruly groups have attempted to up-set 4th of July celebrations in Red Lodge, Carbon County, Montana. Each year the problem has become progressively worse to a point where 400 to 500 persons were involved in a disturbance at the 1975 celebration. Back-up units of police were required from neighboring Powell, Wyoming, Columbus, Montana, and the law enforcement Special Weapons Attack Team (SWAT) from Billings, Montana. Mace and tear gas were also required to maintain control.

Similiar experiences are recorded at West Yellowstone, Gallatin County, Montana, over the same period of time. On July 4, 1964, defiance of laws created a confrontation with authorities ultimately involving near 300 people, 50 of which were leaders of the disturbance. Over 20 local and surrounding law enforcement personnel were needed to control it. In July 1975, between 100 and 150 persons became involved in a similiar incident requiring the sheriff and 10 deputies, 6 highway patrolman, 6 Wyoming police and 5 Boise Idaho lawmen with their police dogs to control them.

Sporadic incidents of a lesser nature have been reported from time to time including strike related incidents and isolated instances near Indian reservations.

Bomb Plants and Threats

Linked closely with civil disorders is the ever present threat of death and destruction from bomb plants. It has become almost commonplace to receive periodic threats of bombs placed in local government buildings, schools, large business, industrial, aircraft, or medical

facilities and other points suitable to disrupt normal daily operations. Fortunately the greatest number are threats only.

By coincidence at the writing of this analysis, a bomb threat has been made on a second State government building following one made 3 days earlier on the State Historical Society building causing evacuation and search procedures to be initiated in both cases. Attempts to obtain statistical information on the number of incidents within the State outlining how many have taken place, the number that were threats only and those that were actual plants has been very difficult. It is known; however, that threats have occurred among hospitals, oil refineries, recreational areas and government facilities which includes city, county, State and Federal buildings throughout the State.

Planning efforts to meet both riot and bomb threat problems have been emphasized at all levels of government. Some political sub-divisions have developed specific civil distrubance control plans separate from other emergency planning. This is done in areas where repeated incidents have required constant revision of plans. Progressive planning within the State is designed to clearly emphasize improved civil disturbance and riot control measures by: (1) education programs for law enforcement personnel (2) conducting exercises (3) improved equipment, techniques, organization and training of law enforcement units.

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Civil Disturbances, Field Manual FM-19-15, Headquarters Department of the Army, Washington D.C. 20314.

Bomb Threats and Search Techniques, Bureau of Alcohol, Tobacco and Firearms, Department of the Treasury, Washington D.C. 20402.

American National Red Cross, Washington D.C. 20006.

SECTION II

DROUGHT

DROUGHT

A drought is a long period of abnormally dry weather affecting a large area. The results of a drought are lack of water for crops and other vegetation and a severe shortage of water for livestock and human use. Crops suffer, use of water for other than essential needs is curtailed, creeks, and streams are abnormally low or dried up, and ground water levels are below normal. A drought of any length and magnitude has other effects which fall in the natural disaster category. These effects include possible forest fires, range fires, and insect infestation (grasshoppers) to name a few.

A history of drought in Montana reflects that during the 1930's the state had its worst drought of record. Also, in the early 1950's the State experienced an extended dry spell. A drought in Montana rarely lasts longer than 2 to 3 years and with the size of the State an extended dry period will not cover the whole State at one time.

An extended dry period or drought affects principally the agricultural economy of the State. With no rain, crop yield is down and this drastically affects the farmer, and with less grass and feed for livestock an economic hardship is felt by the rancher.

The whole State is susceptible to extended dry periods. The north central and eastern part of the State (from the Continental Divide east to the Dakota border) is more prone to dryness because annual precipitation is around 12 3/4 inches of moisture. When the annual precipitation falls below the average in this area the agriculture economy is affected. In general, any year in which the annual precipitation falls below normal in any part of the State, that portion of the State suffers an economic hardship.

Drought is basically a special type of disaster because its occurrence does not require evacuation of an area nor does it constitute an immediate threat to life or property. People are not suddenly rendered homeless or without food and clothing. The basic effect of a drought is economic hardship, but it does, in the end, resemble other type of disasters in that victims can be deprived of their livelihoods and communities can suffer economic decline.

Droughts are difficult to predict, but there are several areas where more research and development could help offset the economic hardship caused by a drought. These areas are as follows: (1) continued federal support and research in water and soil conservation districts (2) continued research and development in improvement of irrigation systems and their efficiency (3) upgrading the Federal Crop Insurance Program and (4) continued research in commercial cloud seeding operations.

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Assessment of Research on Natural Hazards, Gilbert F. White and J. Eugene Haas, 1975, page 372-399.

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SECTION III

EARTHQUAKES

EARTHQUAKES[1]

An analysis of earthquake risk can be made at two levels:

1. A broad discussion of the hazard for the whole state.
2. A detailed analysis for specific regions.

For the purpose of this analysis the report will cover Level 1.

Earthquakes are ranked according to their intensity (observed effect) and magnitude (energy released). The following definitions and comparison chart are quoted from the National Oceanic and Atmospheric Administration pamphlet "Earthquakes", 1972.

Intensity is an indication of an earthquake's apparent severity at a specified location, as determined by experienced observers. Through interviews with persons in the stricken area, damage surveys, and studies of earth movement, an earthquake's regional effects can be systematically described. For seismologists and emergency workers, intensity becomes an efficient shorthand for describing what an earthquake has done to a given area.

The Modified Mercalli Intensity Scale generally used in the United States grades observed effects into twelve classes ranging from I, felt only under especially favorable circumstances, to XII, damage total. The older Rossi-Forel Intensity scale, or R. F., has ten categories of observed effects, and is still used in Europe. Still other intensity scales are in use in Japan and the U.S.S.R.

Rating earthquakes by intensity has the disadvantage of being always

1. Based principally on data provided by Anthony Qamar, Assistant Professor, Geology Department, University of Montana.

relative. In recent years, intensity ratings have been supplemented by an "objective" scale of earthquake magnitude.

Magnitude expresses the amount of energy released by an earthquake as determined by measuring the amplitudes produced on standardized recording instruments. The persistent misconception that the "Richter Scale" rates the size of earthquakes on a "scale of ten" is extremely misleading, and has tended to mask the clear distinction between magnitude and intensity.

Earthquake magnitudes are similar to stellar magnitudes in that they describe the subject in absolute, not an arithmetic, scale. An earthquake of magnitude 8, for example, represents seismograph amplitudes ten times larger than those of a magnitude 7 earthquake, 100 times larger than those of a magnitude 6 earthquake, and so on. There is no highest or lowest value, and it is possible here, as with temperature, to record negative values. The largest earthquakes of record were rated at magnitude 8.9; the smallest, about minus 3. Preliminary magnitude determinations may vary with the observatory, equipment, and methods of estimating--the Alaska earthquake of March 1964, for example, was described variously as magnitude 8.4, 8.5, 8.6 by different stations.

Magnitude also provides an indication of earthquake energy release, which intensity does not. In terms of ergs,* a magnitude 1 earthquake releases about one billionth the energy of a magnitude 7 earthquake; a magnitude 5, about one thousandth that of a magnitude 7.

---

*In the centimeter-gram-second system, an erg is the unit of work equal to a force of 1 dyne acting through a distance of 1 centimeter; a dyne is the force required to accelerate a free-standing gram mass 1 centimeter per second.

APPROXIMATE RELATIONSHIPS

Magnitude	Energy-Released[3] (Ergs)	Expected Annual Incidence[1]	Felt Area (sq. miles)	Distance Felt[2] (st. miles)	Intensity (Maximum Expected Modified Mercalli)[3]
3.0-3.9	$2x10^{16}$-$4x10^{17}$	49,000	750	15	II-III
4.0-4.9	$6x10^{17}$-$1x10^{19}$	6,200	3,000	30	IV-V
		1 thousand tons[4] of TNT 4.2×10^{19} ergs			
5.0-5.9	$2x10^{19}$-$4x10^{20}$	800	15,000	70	VI-VII
6.0-6.9	$6x10^{20}$-$1x10^{22}$	120	50,000	125	VII-VIII
		1 million tons[4] of TNT 4.2×10^{22} ergs			
7.0-7.9	$2x10^{22}$-$4x10^{23}$	18	200,000	250	IX-X
8.0-8.9	$6x10^{23}$-$1x10^{24}$	1	800,000	450	XI-XIII

[1]B. Gutenberg and C. F. Richter, Seismicity of the Earth and Associated Phenomena, Princeton University Press, Princeton, N.J., 1954, page 18.

[2]H. Benioff and B. Gutenberg, "General Introduction to Seismology," Earthquakes in Kern County During 1952, State of California, Division of Mines, Bulletin 171, San Francisco, 1955, page 133.

[3]Prepared by the National Earthquake Information Center from C.F. Richter, Elementary Seismology, W. H. Freeman and Co., San Francisco, 1958, pages 353, 366.

[4]U.S. Department of Defense, The Effects of Nuclear Weapons, S. Glasstone, Ed.; Government Printing Office, Washington, D. C., 1962, page 14.

Figure 1, Page 18, shows earthquakes, greater than magnitude 2, which occurred in Western Montana from July 26, 1974 to February 28, 1975. The most recent "official" seismic risk map of the United States is still the NOAA map produced by Algermissen in 1969, Figure 2, Page 19. According to Algermissen, the southwestern portion of Montana has been classified as "Zone 3", a region of possible major damge. The zoning in Figure 2 is based on the largest earthquake intensity to which a region has been subjected in historical times. Classification on this basis gives no information on the rate of recurrence of damaging earthquakes. Maps which actually give the probability of occurrence of a damaging earthquake are now in preparation by the U.S. Geological Survey. One problem with a map such as that in Figure 2 is that it is possible that some regions are improperly zoned simply because our short historical records have indicated no damaging earthquakes in areas which can, in fact, be subjected to them. Such a condition may exist for the Flathead Lake region of Montana.

Figure 3, Page 20, shows epicenters for the more important Montana earthquakes which have occurred from 1925 to 1973. These earthquakes have instrumentally determined epicenters and are taken from the NOAA earthquake hypocenter data file. Additional earthquakes for which only felt reports are available (for determining approximate epicenters) and which are not shown in Figure 3 can be found in the publication Earthquake History of the United States and the annual series United States Earthquakes. Figure 3 shows that most Montana earthquakes occur in a northwest trending zone which traverses Yellowstone, Three Forks, Helena, and Flathead Lake.

The most active area in Montana is the Yellowstone-Hebgen Lake region which may be largely controlled by east-west trending faults which extend into central Idaho. The largest earthquake recorded in the entire Rocky

FIGURE 1

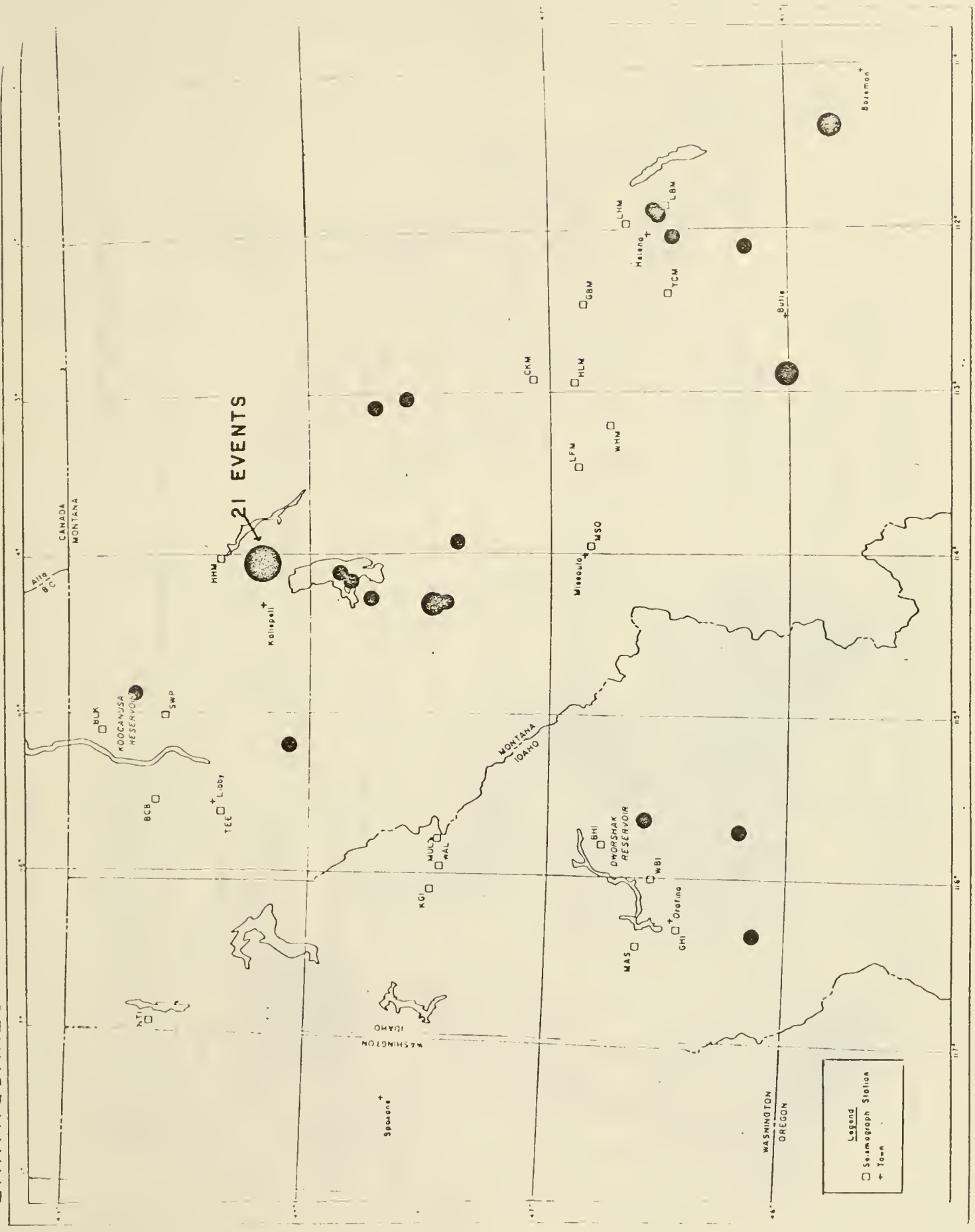
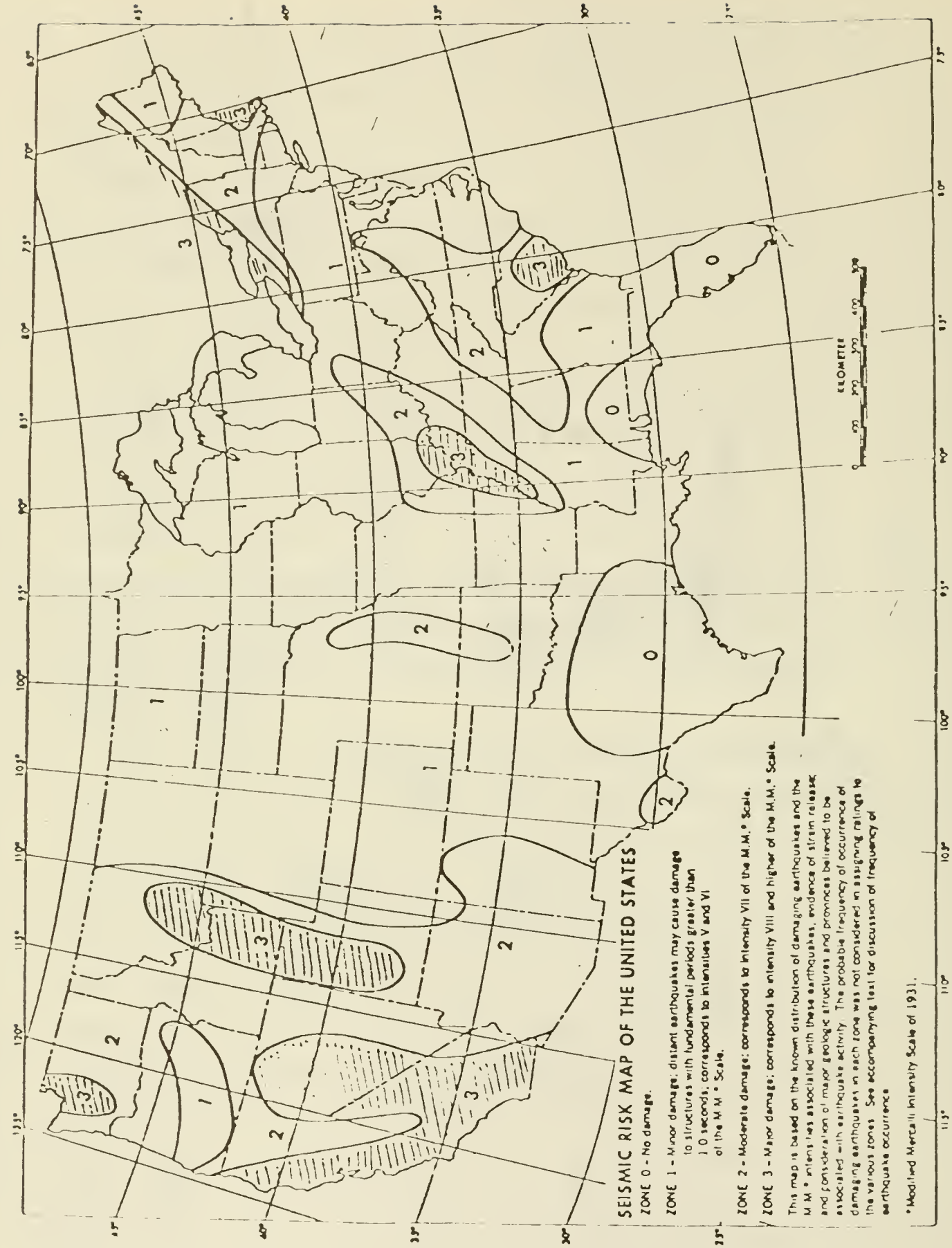

EARTHQUAKES MAG > 2.0 JUL 26 1974 — FEB 28 1975
21 EVENTS
CANADA
MONTANA
Alta
B.C.
MHW
Kalispell
KOOCANUSA RESERVOIR
BLK
SWP
BCB
TEE
Libby
MONTANA
IDAHO
MUL
WAL
KGI
BHI
DWORSHAK RESERVOIR
WBI
Orofino
GHI
WAS
XTI
IDAHO
WASHINGTON
Spokane
WASHINGTON
OREGON
Missoula
WSO
CKM
HLW
LFW
WHW
GBW
YCW
LHW
LBW
Helena
Butte
Bozeman
Legend
Seismograph Station
Town

Figure 2


SEISMIC RISK MAP OF THE UNITED STATES
ZONE 0 - No damage.
ZONE 1 - Minor damage: distant earthquakes may cause damage to structures with fundamental periods greater than 1.0 seconds; corresponds to intensities V and VI of the M.M.° Scale.
ZONE 2 - Moderate damage: corresponds to intensity VII of the M.M.° Scale.
ZONE 3 - Major damage; corresponds to intensity VIII and higher of the M.M.° Scale.
This map is based on the known distribution of damaging earthquakes and the M.M.° intensities associated with these earthquakes, evidence of strain release and consideration of major geologic structures and provinces believed to be associated with earthquake activity. The probable frequency of occurrence of damaging earthquakes in each zone was not considered in assigning ratings to the various zones. See accompanying text for discussion of frequency of earthquake occurrence.
° Modified Mercalli Intensity Scale of 1931.
KILOMETERS

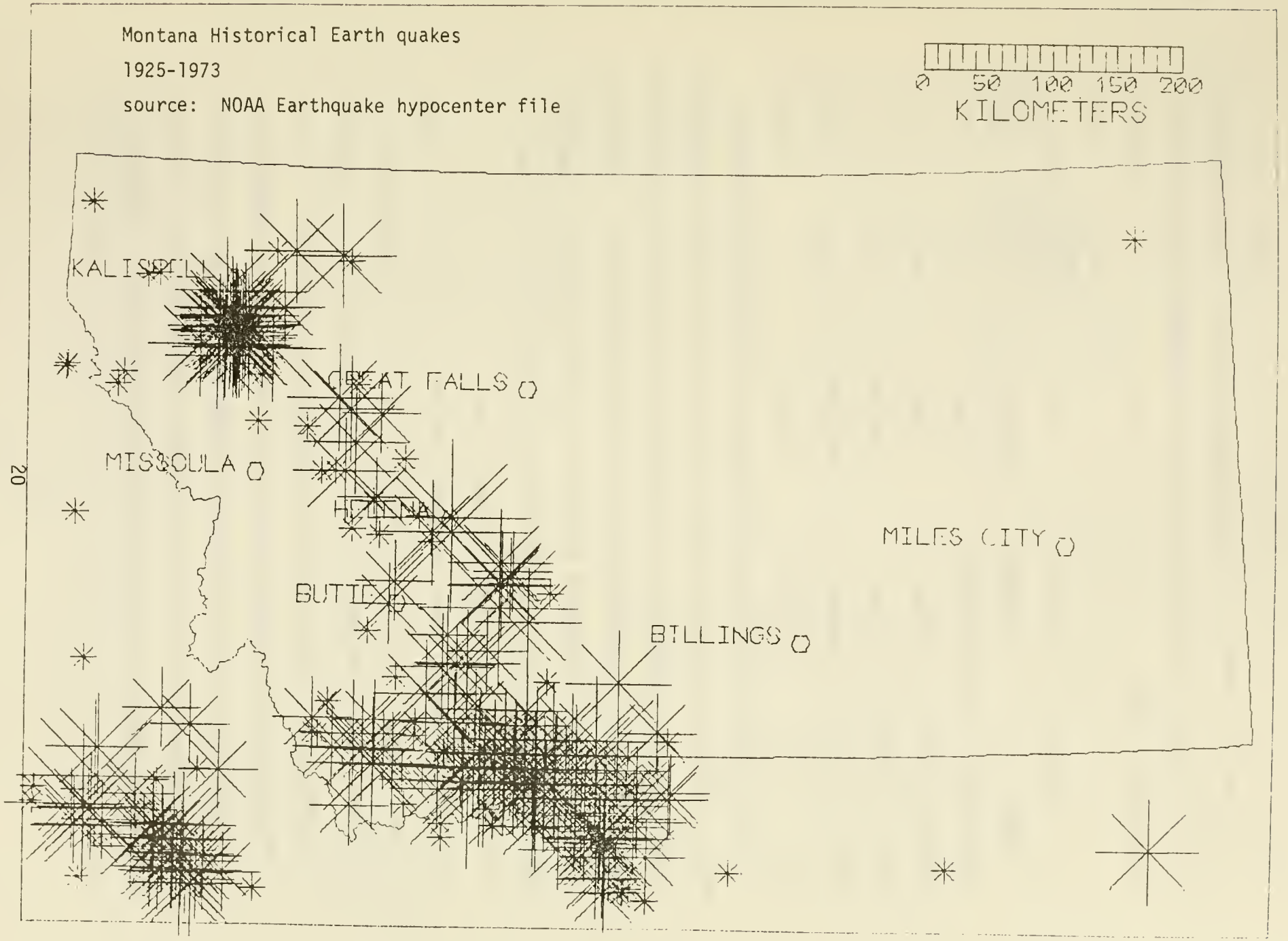

Montana Historical Earth quakes
1925-1973
source: NOAA Earthquake hypocenter file
0 50 100 150 200
KILOMETERS
KALISPELL
GREAT FALLS
MISSOULA
HELENA
BUTTE
BILLINGS
MILES CITY
20

Figure 3

Mountain seismic belt (Friter Mountain Seismic Belt) occurred in 1959 near Hebgen Lake, Montana. Five earthquakes which have exceeded Modified Mercalli Intensity VIII (Zone 3 type events - Figure 2) have occurred in Montana since 1925.

Date	Location	Felt Area (mi 2)	Maximum Intensity (Modified Mercalli)	Richter Mag.
June 27, 1925	Near Lombard	310,000	VIII	6 3/4
October 18, 1935	Helena	230,000	VIII	6 1/4
October 31, 1935	Helena	140,000	VIII	6
November 23, 1947	Madison City	150,000	VIII	6 1/4
August 17, 1959	Hebgen Lake	600,000	X	7.1

On the basis of the historical record the entire southwest portion of Montana should be considered a region of very high seismic risk. Special planning should be considered for development of critical structures, such as hospitals and fire stations, wherever this condition exists. This area is the most seismically active in Montana. In the summer of 1975 another magnitude 6 event occurred in Yellowstone National Park and earthquakes occur regularly in the vicinity of Hebgen Lake.

The University of Montana is presently operating 13 seismograph stations, four near Libby, eight between Missoula and Helena, and a World Wide Seismograph Station (WWSSN) observatory at Missoula (Figure 1). Data from these sources add significantly to our knowledge in this field.

Damaging earthquakes have occurred in the Three Forks and Helena regions in 1925 and 1935. These areas are active today and should be considered zones of high seismic risk. We have much new information on present day seismicity in the Helena region. Much of it appears to be concentrated in

the Scratch Gravel hills to the northwest of Helena, It is interesting that from the Helena region comes our earliest records of earthquake activity in Montana. The intensity VI events which were felt in Helena in May 22, 1869 and in December 10 and 11, 1872, establish this area as one with a long history of damaging earthquakes. Detailed studies of earthquake activity in the Three Forks region are still minimal due to a lack of seismograph stations there. However, our seismograph stations in the Helena area which have been in operation for 1½ years have recorded a number of moderated earthquakes from the Three Forks region which suggests that this area is one of the most active in Montana and should be considered one of high risk.

The Flathead Lake area in Northwest Montana is of particular interest. Damaging earthquakes have occurred here in March 1952 (VII), April 1, 1969 (VII), 1971, and February 1975 (Magnitude 5). This activity suggests that the western side of Flathead Lake and the Kalispell region may be seismically hazardous. Historically there has never been a large earthquake in this region, but the present activity and the geologically young faults in this vicinity suggest that a damaging earthquake is possible.

It is clear from Figure 3 that earthquake risk in Montana is principally restricted to the western third of the State. Figure 4, Page 23, illustrates the principal faults in Western Montana. Not all of these are known to be active. The entire central and eastern portion of the state appears to be an area of low seismic risk. In addition, the extreme western portion of the State also appears to have low seismic risk except in the area west of Hebgen Lake. Earthquake damage in these areas would be limited generally to shaking effects from earthquakes in the Intermountain seismic belt. It should be remembered that in all areas the greatest earthquake risk is from

Figure 4

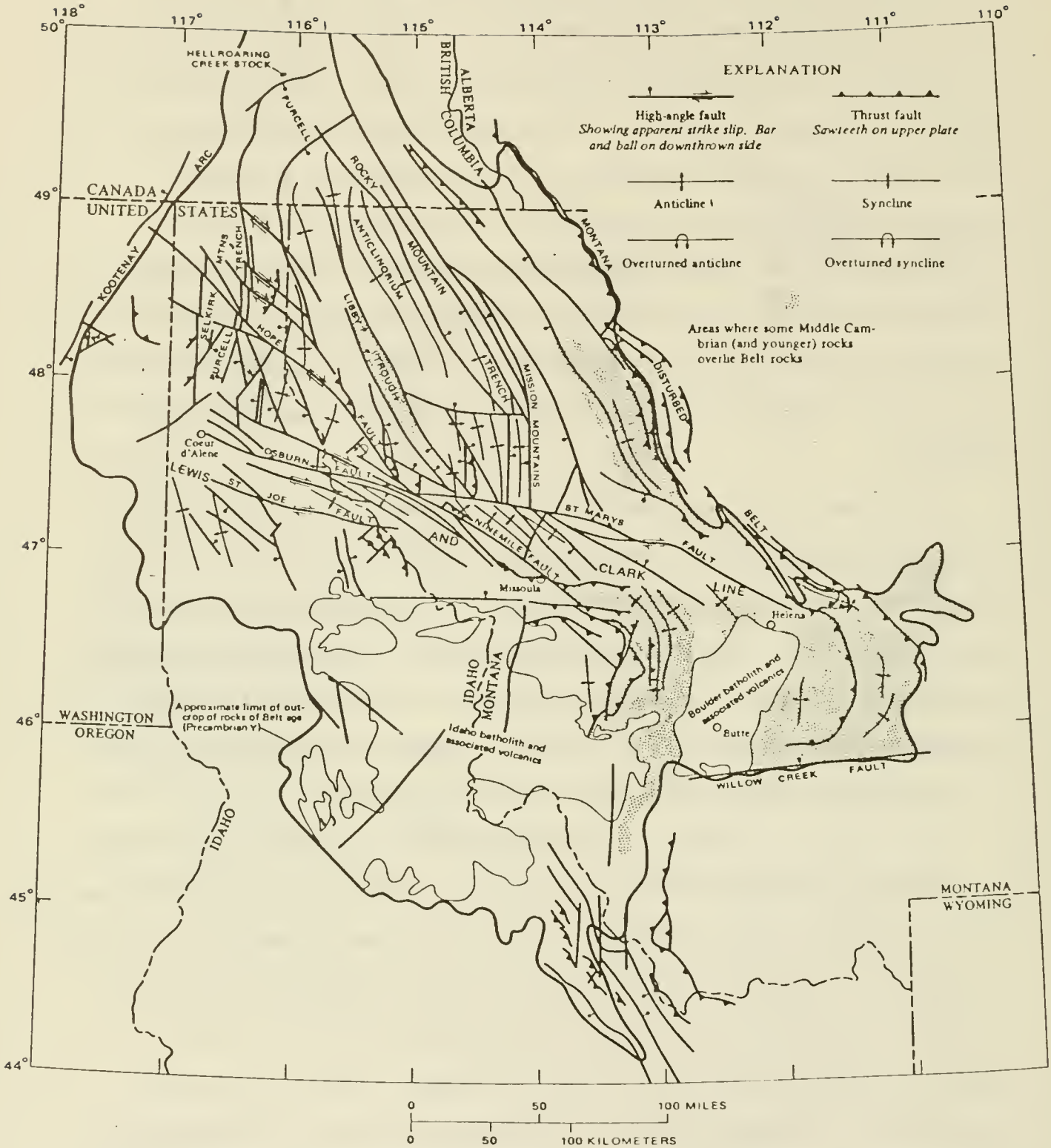
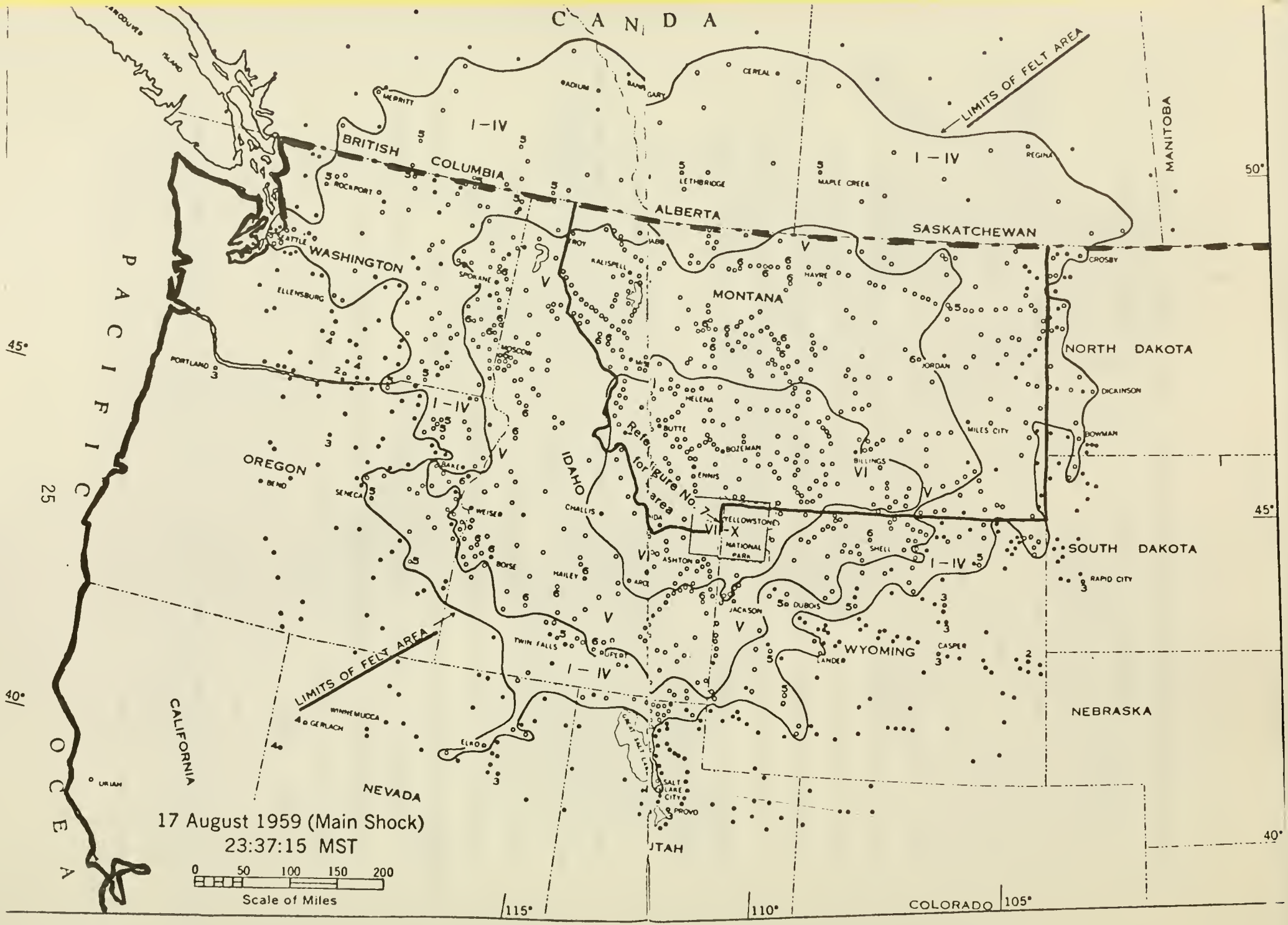


FIGURE 3. - Principal folds and faults in Belt terrane. Compilation by J. E. Harrison; revised from Bayley and Muehlberger (1968), largely through application of as-yet-unpublished 1:25,000 and 1:250,000 geologic mapping by various members of the U.S. Geological Survey, including A. B. Griggs, J. D. Wells, M. R. Mudge, R. L. Earhart, J. E. Harrison, F. K. Miller, G. D. Robinson, and E. T. Ruppel.

the shaking effects of seismic waves radiated from a fault at the time of an earthquake. (See Figure 5, Page 25, for area over which the 1959 Hebgen Lake quake was felt.) Damage due to the direct effect of fault offsets on structures is much more improbable and need be considered only when development takes place in the immediate vicinity of active faults. For example, experience has allowed the California Bureau of Mines and Geology to estimate that the total dollar loss to California from 1970 to 2000 will be 21 billion dollars from shaking damage and 8 million dollars from fault displacement damage. These estimates apply for the case in which no further zoning laws or building requirements designed to mitigate earthquake damage are instituted in California. On a reduced scale due to the differences in concentration of population and economic development some idea can be gained of potential damage from earthquakes in Montana.

Recent small earthquakes which have occurred in Northwest Montana are shown in Figure 6, Page 26. Only epicenters within the box outling Northwestern Montana are indicated. (During the 1½ year period of Figure 6, the southwestern portion of the State was actually the most active.) A study of the more than 600 small earthquakes shown in Figure 6 indicates a seismicty pattern which is very similar to that of the historical record. This is one of the values of a study of small earthquakes utilizing a regional network of seismographs. The improved accuracy of epicenter location now allows the relationship of present day seismicity and known geologic faults to be seen in greater detail. For example, Figure 7, Page 27, shows that much of the earthquake activity northwest of Helena appears to be associated with Saint Marys and Avon Valley faults of the Clark Fork fault zone rather than the overthrust faults just to the north (see also Figure 4). In addition, areas such as the Avon Valley and the Helmville and Lincoln region appear



Area affected by earthquake of August 17.

Roman numerals are Modified Mercalli Intensity

Figure 5

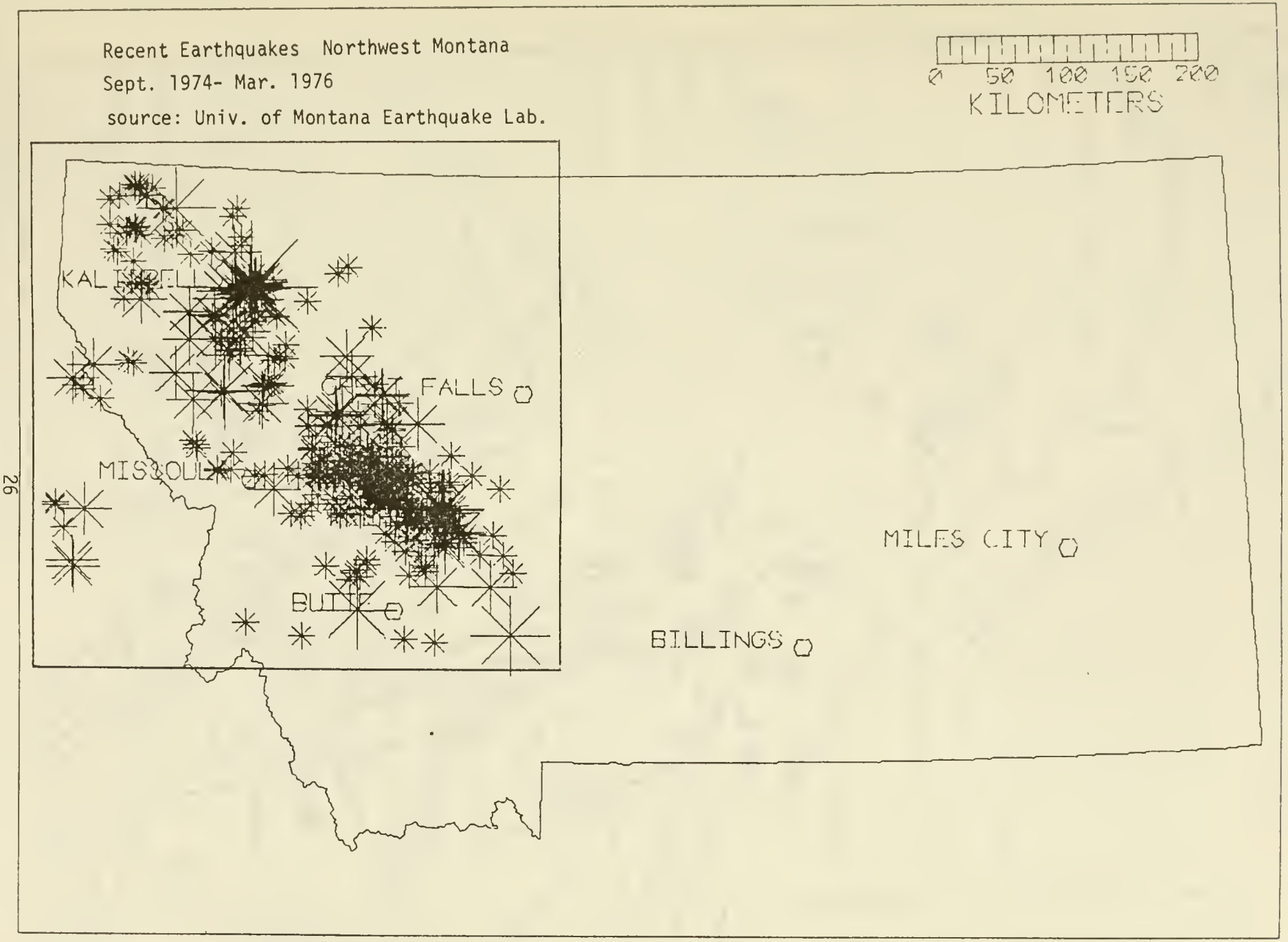
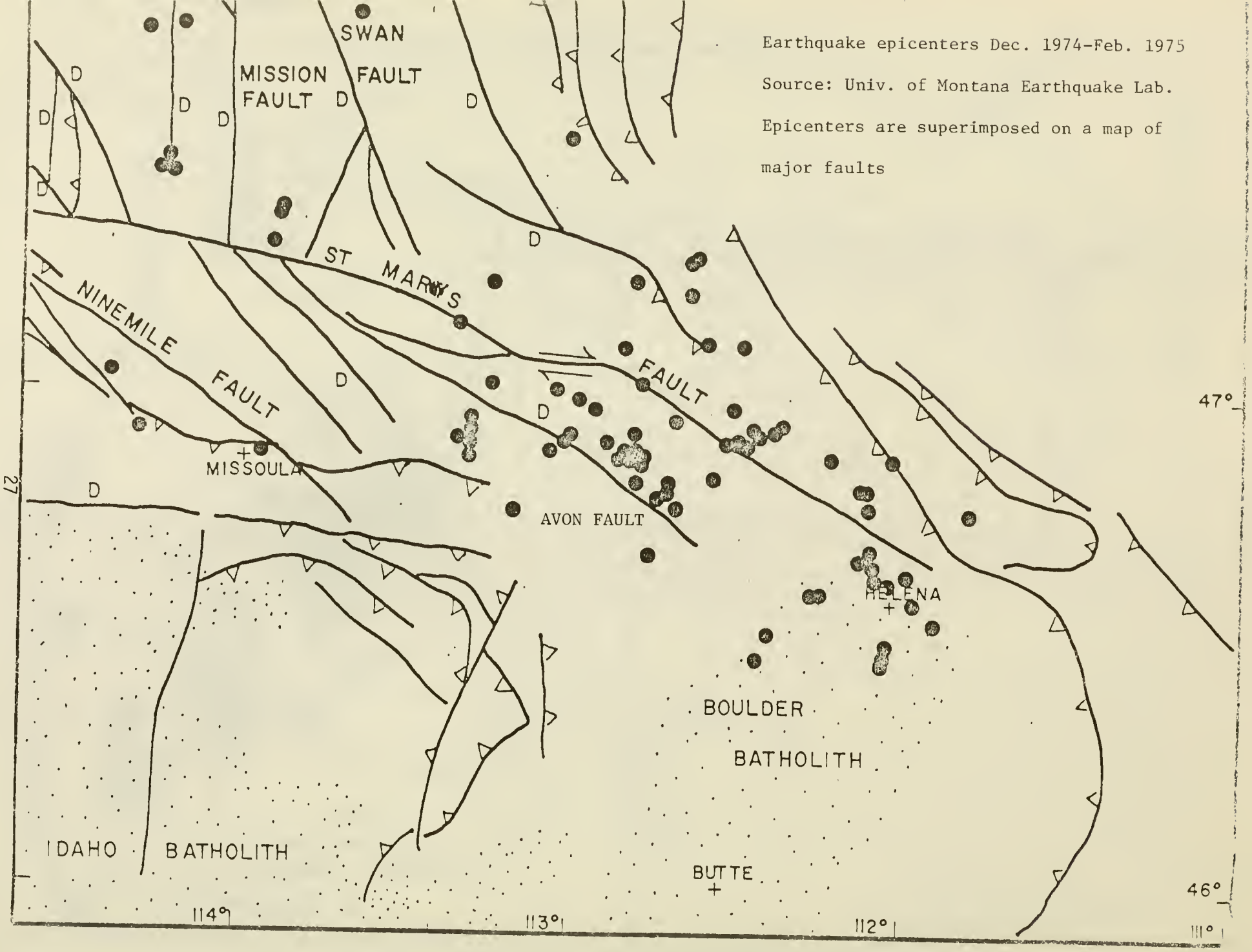


Figure 6

Only earthquakes within box outlining northwest Montana are shown.



Earthquake epicenters Dec. 1974-Feb. 1975

Source: Univ. of Montana Earthquake Lab. Epicenters are superimposed on a map of major faults

Figure 7

to be zones of periodic earthquake swarms. The relationship of these swarms to earthquake hazard is still not clear.

Common effects of this violent phenomenon are familar to most residents of earthquake prone areas due to extensive television and other news coverage of past quakes. Structual damage to masonry buildings, deaths due to falling bricks and cornices, ruptured gas, water and sewer lines, fires, etc. are all too frequent results of violent earthquakes in urban areas. Direct causes of building and facility failures are not as obvious. For instance, in describing the behavior of geologically recent sedimentary deposits, one authority has stated:

"Interstitial water in the pores in sediment is often ejected during an earthquake when it shakes young sediments and one suddenly finds onesself swimming in mud with no apparent source of the water. This usually occurs for several minutes after the earthquake and the liquified ground, with sinking cattle, people and houses, is largely the source of the myth about the 'ground opening up to swallow you'. Such effects are largely confined to areas with a high water table such as found along river deltas in the vicinity of the town of Kalispell. Course gravelly sediments are less likely to behave this way than are fine silty debris. It has been suggested by some authors in a 1969 paper of the Seismological Society of America that most building failures where structures are located on porous wet ground during an earthquake are not the result of the shaking of the building, but rather the result of foundation failures associated with spontaneous liquifaction - and that this is what really does most of the damage during an earthquake. During spontaneous liquifaction, pipelines, sewers, septic tanks, and most underground utilities rise to the surface - even when full of water or sewage - thus

causing their failure and potential public health problems. Poles driven into the ground, such as utility poles, are also forced up out of the ground by dispersive forces - simply because they are larger than the mean grain size of the material in which they sit."

The same authority goes on to identify other events often encountered:

"Another hazard associated with earthquakes is the release of water for local flooding. Lakes and reservoirs along fault lines may drain suddenly - even through concrete dams or bedrock lake outlets if the daming structures are offset. The lakes and reservoirs along the west base of the Mission Range are prime local examples of potentially damaged basins during motion of the range-front fault system. Communities with water supply towers or tanks on hilltops can anticipate possible failure of these structures if they are partially filled and waves develop within the tanks. Likewise shoreline residents of larger bodies of water like Flathead Lake may experience larger than average waves during an earthquake. Such seismically induced water waves in lake basins or bays are called seiches and occur just like water slopping back and forth in a pan when you shake it. Recent small earthquakes near Flathead Lake have induced 3-4" standing waves on that lake which sweep back and forth from shore to shore until the energy is dissipated - hours or days later. In the case of deep earthquakes or those far from the lake, the deeper the lake, the larger the potential waves which may be generated - and waves 5-feet in height are about the maximum expected for Flathead or other similar large deep reservoirs except in confined bays where energy may be focused and slosh up a beach high enough to sweep off a few cabins and most docks. However, even small waves can sometimes overtop a dam with possibly disastrous erosional results. A

shallow lake like Georgetown, above Drummond, could if near enough the epicenter of a moderate earthquake be the site of wave-induced dam failure with possibly severe consequences for those living downstream such as in Drummond or Missoula.

Delta sediments, if steep as are those at the north end of Flathead Lake, can fail during an earthquake giving rise to an underwater landslide of sorts. Such shear-failure, induced by the actual earthquake shaking, can create a large wave in a confined body of water like Flathead Lake which travels at high speeds and will slosh up all steeply sloping shores and would be expected to damage homes and highways.

Lastly earthquake faulting does occur along valleys where the earthquake zone has made for easy erosion by rivers and thus logical positioning for towns and their water supplies. Water supply failures are very common in earthquake areas through disruption of mains, reservoir failures, and tank failures. Loss of the water supply, and associated flooding, creates public health problems and vulnerability to fires. These hazards can be minimized by wise location of water storage and distribution systems."

The cumulative effects of an earthquake on the average community can be devastating. When that community is the seat of government, such as our State Capital, results could be catastrophic. Because of its location in one of the areas of highest risk, Helena is vulnerable. An earthquake approaching the magnitude of the Hebgen Lake event, if centered close to Helena, could necessitate the abandonment of the Capitol and other administration buildings. Detailed planning toward relocating State government under such conditions is indicated.

Planning considerations include adoption of appropriate building

codes in active areas, scheduled inspections of structures such as apartment houses, dams, and public buildings the failure of which could spell disaster. In addition, a public information program is warranted. In addition to probability and effects of earthquakes this should cover basic home protective measures such as how to shut off utility lines, how to select the safest areas in homes, schools, and etc.

Future Research

> "On February 3, 1974 a major earthquake was predicted for a locality in Hopei Province of mainland China for a year and a day later: February 4, 1975. The earthquake arrived on schedule with a magnitude of 7.3 on the Richter scale. Major damage resulted, but absent were the usual great tolls of lives lost and wholesale injuries. The reason, of course, was that critical areas had been evacuated.
>
> The Chinese are in the lead in forecasting earthquakes. They haven't yet perfected the art by any means, but their progress is amazing. In the United States, too, we may one day be able to alert threatened cities to impending major earthquakes and give precise arrival times. Our seismologists are working on it."
>
> Kevin Kilpatrick, "Doing Something" About Earthquakes, Survive, Nov.-Dec. 1975.

There is need for uninterrupted collection and analysis of earthquake data to further identify risk areas and effects of earthquake activity.

The University of Montana is now engaged in research which directly bears on the problem of earthquake hazard in Montana. In particular, it

is planned to analyze in greater detail the relationship of present-day seismicity to geologically mapped faults so as to determine which faults are active. Also, the occurrence rate of microearthquakes as a function of magnitude will be used to estimate the return time of large magnitude events in various regions of Montana. This will be related to the historical earthquake information from all available sources.

Desirable long-range research goals include:

1) Establishment of seismograph networks in the Flathead Lake and Three Forks region for further study of the seismicity and tectonics of those regions.
2) Further study of the activity of faults in Montana. This should not only include analysis of seismicity but also additional geological studies to determine the extent of quaternary faulting (i.e. during the last 2-3 million years). In certain cases (e.g. Hebgen Lake) trenching of known faults could help to better determine the long-term history of faulting by dating of offset sedimentary strata within the trenches.

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SECTION IV

FLOODS

FLOODS

The foremost cause of floods in Montana is rapid thawing of abnormally high water content snows from unseasonally high temperatures. This condition is often compounded by warm rains on the snow controlled by a stable or holding weather pattern in a given area. This gives rise to excessive run-off in critical drainages leading to major streams ultimately causing flooding from light to severe stages. The geographical structure dictates those areas where recurring problems can be identified and the source from which the cause is derived. For the most part the problem is in the mountainous portion of the State predominately the west one third or Continental Divide area. (Maps Pages 35-36) For this reason major rivers e.g. Missouri, Sun River, Musselshell, Yellowstone, Flathead, Clark Fork, Milk and Marias Rivers contribute the greatest amount of accumulation causing the most problems downstream.

During winter months these rivers also accumulate massive amounts of ice affected periodically by warm spells of weather causing ice jams which often trigger uncontrollable flooding during the spring thaw.

Emergency conditions within the State of Montana created by flood waters may be identified and categorized in three ways: limited damage, intermediate damage and heavy damage. (Figure 1, Page 37)

Category One consists of those counties which suffer relatively light damage usually caused by slightly abnormal spring run-off, minor ice jams in smaller streams or short duration flash flooding from heavy thunderstorms. Damage is usually light and recovery can be accomplished on the local level with some aid from neighboring jurisdictions and technical assistance from State agencies if needed. Flooding in this category is classified as light, causing limited damage.

MONTANA

MAJOR RIVER BASINS IN MONTANA
(APPROXIMATED ALONG COUNTY LINES)

No. 1052 — County Outline Map
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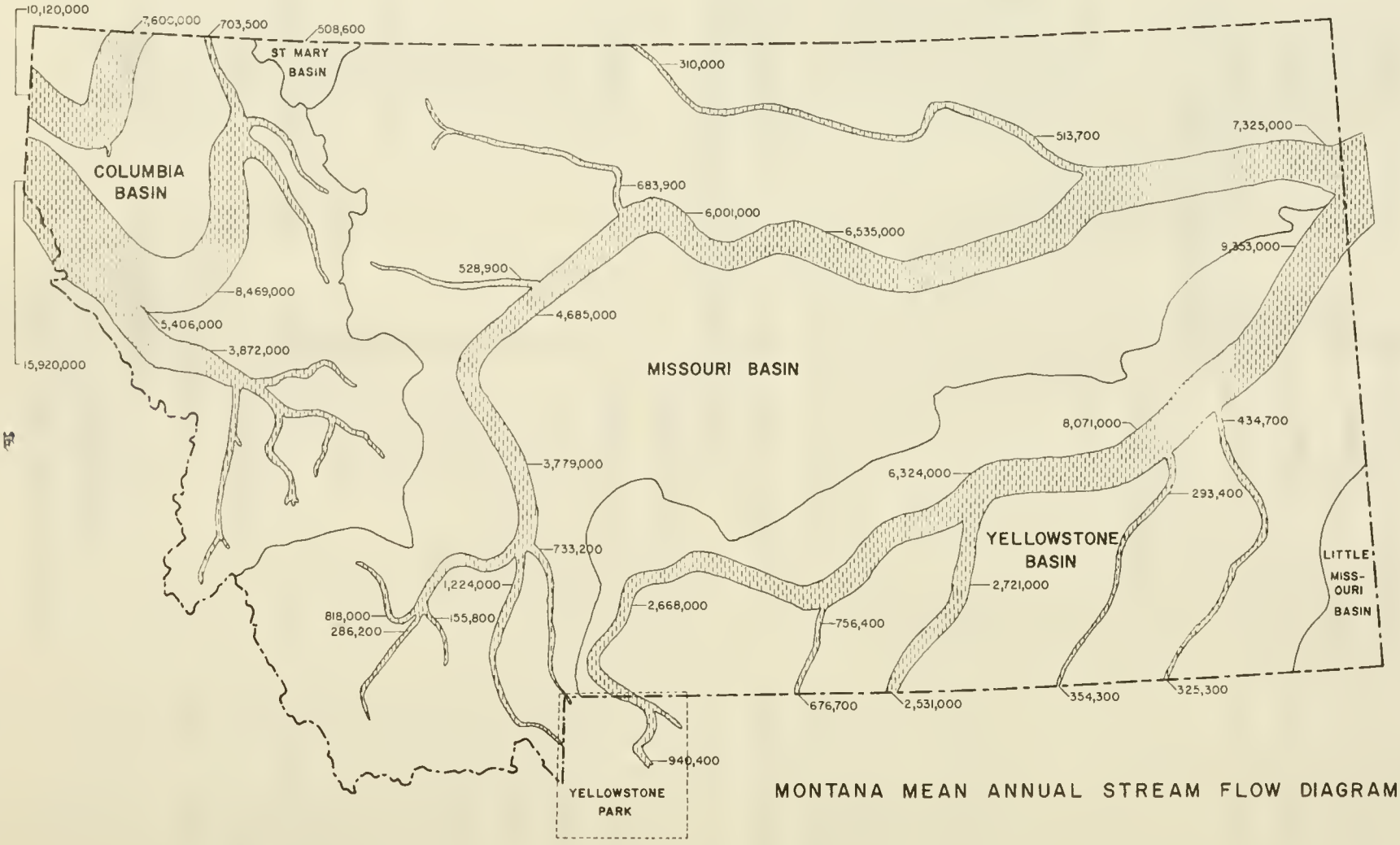


FIGURES: Average annual discharge in acre feet

COUNTY FLOOD CATEGORIZATION

Category One

Light Flooding (Limited Damage)

1. Big Horn
2. Blaine
3. Broadwater
4. Carter
5. Choteau
6. Daniels
7. Fallon
8. Garfield
9. Granite
10. Hill
11. Judith Basin
12. Lake
13. Liberty
14. McCone
15. Meagher
16. Petroleum
17. Phillips
18. Powder River
19. Prairie
20. Roosevelt
21. Rosebud
22. Sheridan
23. Silver Bow
24. Treasure
25. Valley
26. Wibaux

Category Two

Intermediate Flooding (Moderate Damage)

27. Beaverhead
28. Carbon
29. Custer
30. Dawson
31. Deer Lodge
32. Fergus
33. Gallatin
34. Golden Valley
35. Jefferson
36. Madison
37. Mineral
38. Musselshell
39. Park
40. Powell
41. Richland
42. Stillwater
43. Sweet Grass
44. Toole
45. Wheatland

Category Three

Major Flooding (Heavy Damage)

46. Cascade
47. Flathead
48. Glacier
49. Lewis & Clark
50. Lincoln
51. Missoula
52. Pondera
53. Ravalli
54. Sanders
55. Teton
56. Yellowstone

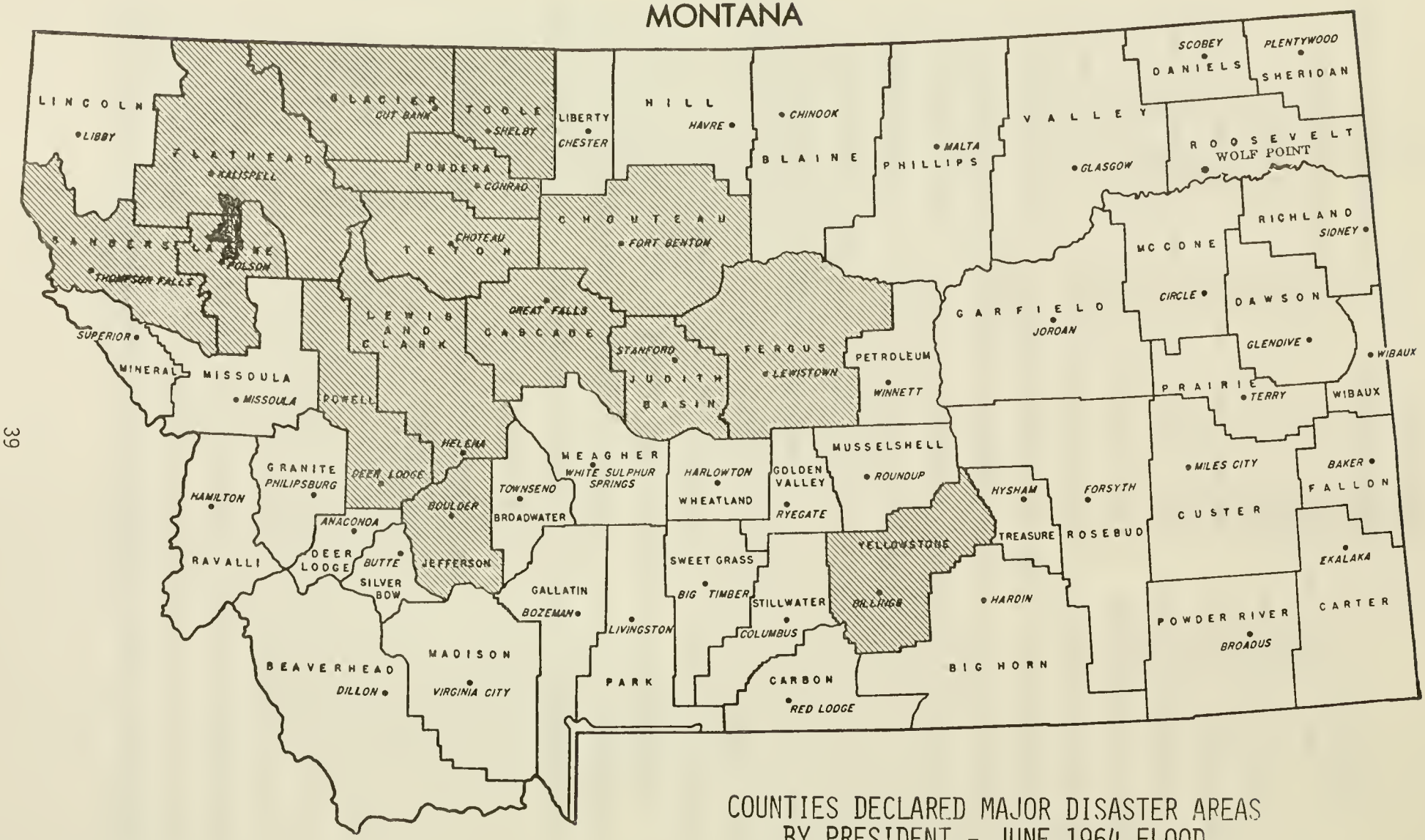
Arbitrary rating based on past records, potential population threatened and values of land and improvements in flood plain.

Figure 1.

Category Two is those counties classified in the intermediate flooding class. These counties are located on or near major rivers or streams with broad drainage areas affected by spring run-off, heavy rains concentrated at the head of drainage areas and ice jams. History records that intermediate flooding affects water systems, sewers and sewer lagoons, public utilities, roads, culverts and bridges and other services, but on a moderate scale. For the most part erosion occurs in lowland areas involving farm land, irrigation systems, fences and livestock corrals. Examples of this type of destruction were experienced by Musselshell, Golden Valley, and Wheatland counties in June 1967. Floods in this category are normally of short duration and trigger aid by Agricultural Stablization and Conservation Service, Soil Conservation Service, Small Business Administration, Corps of Engineers, Red Cross and others based on authority contained within their respective areas of responsibility. Flooding in this case is intermediate, causing moderate damage.

Category Three is those counties having a history of major flooding resulting in a Presidential Disaster Declaration and substantial recovery aid from State and Federal sources. Prime examples are: (1) The floods of 1964 in the northwest and central district of the State involving 14 counties: Glacier, Toole, Flathead, Sanders, Lake, Pondera, Teton, Lewis & Clark, Powell, Cascade, Choteau, Judith Basin, Fergus and Jefferson (Map, OEP-172-DR, Page 39). This disaster resulted in the loss of 34 lives and an economic loss of more than $50,000,000.00. Yellowstone County was also part of this declaration, but records do not indicate the extent of damages in that county. (2) The flood of January 1974 when the more extreme Northwest district of the State was besieged by floodwaters developed from a heavy snow pack in the mountains

MONTANA



COUNTIES DECLARED MAJOR DISASTER AREAS BY PRESIDENT - JUNE 1964 FLOOD

OEP-172-DR

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Helena

with unseasonably warm temperatures and rains combined with ice jamming. This involved seven counties: Lincoln, Sanders, Flathead, Glacier, Mineral, Missoula[1], and Deer Lodge included in a Presidential disaster declaration (Map FDAA-417-DR, Page 41) with no loss of life but economic losses of approximately $16,000,000.00 including damage to forest service roads, bridges and facilities, private property, etc. (3) In June of 1975 basically the same counties involved in the 1964 flood were again hit as shown on map FDAA-472-DR, Page 42. There was severe flooding with no loss of life, but economic losses totalled almost $35,000,000. In this category the flooding is severe and the damage heavy.

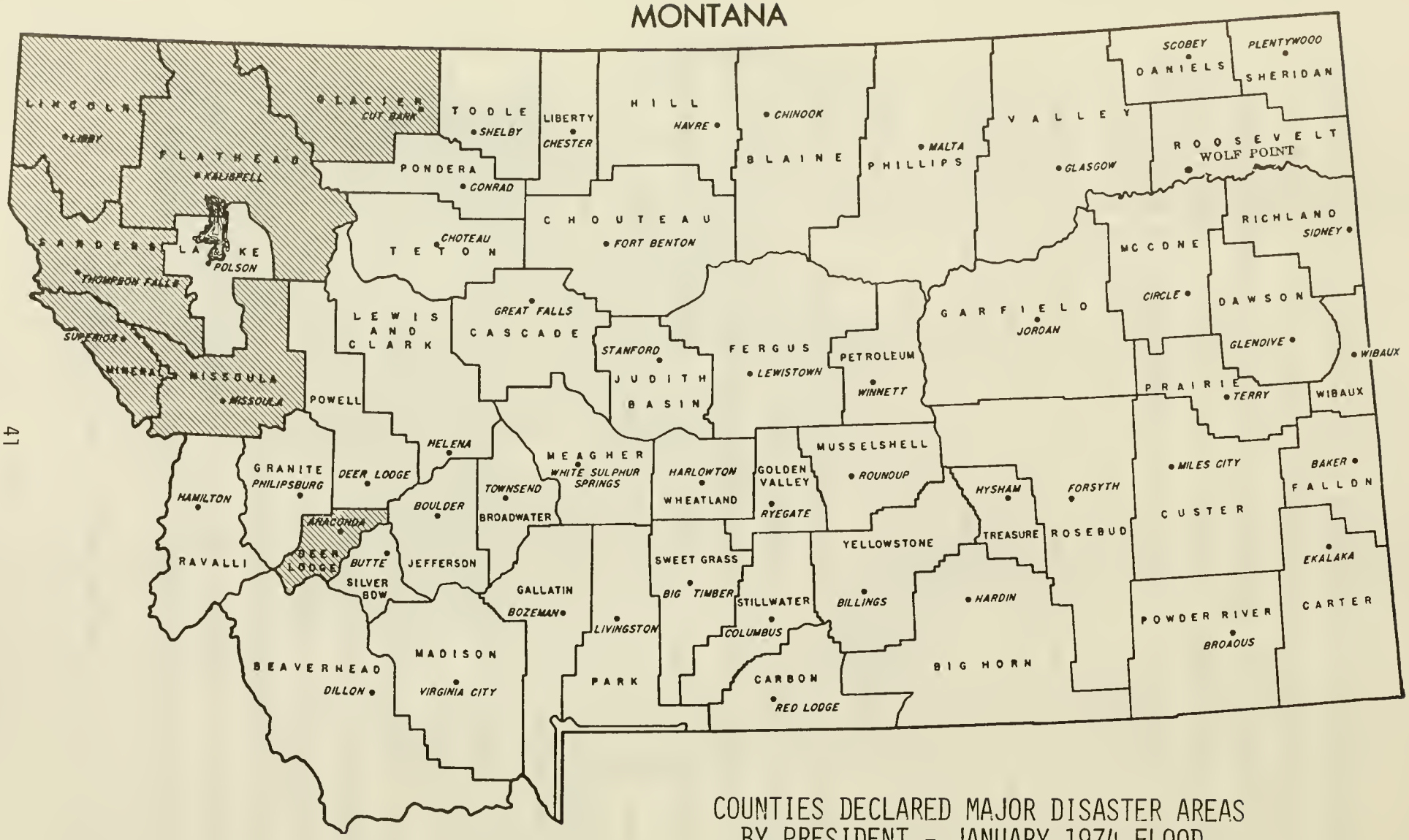
Flash flooding affecting the same drainages is also common during the summer storm season. Records from the Helena River District National Weather Service show flood frequency dating from 1897 to the present. In at least 25 of those years flooding ranged from intermediate to severe.

Important additional factors relating to potential flood problems are the number of concrete and earth fill dams throughout the State designed for power or irrigation or both. Geographical location, capacity, principal features and other technical data are contained in Volume III, National Program of Inspection of Dams, May 1975, Corps of Engineers. This and other documents are on file and are available from the Water Resources Division, Montana Department of Natural Resources and Conservation.

Extensive irrigation projects are also located throughout the State supporting large and lengthy canals running through populated areas and localities having substantial residential, business, and industrial concentration. For example the Billings Bench Water Association Canal, in Yellowstone County, carries sufficient water to irrigate approximately

[1] County officials resolved not to accept reimbursement from Federal funds.

MONTANA



COUNTIES DECLARED MAJOR DISASTER AREAS BY PRESIDENT - JANUARY 1974 FLOOD

FDAA-417-DR

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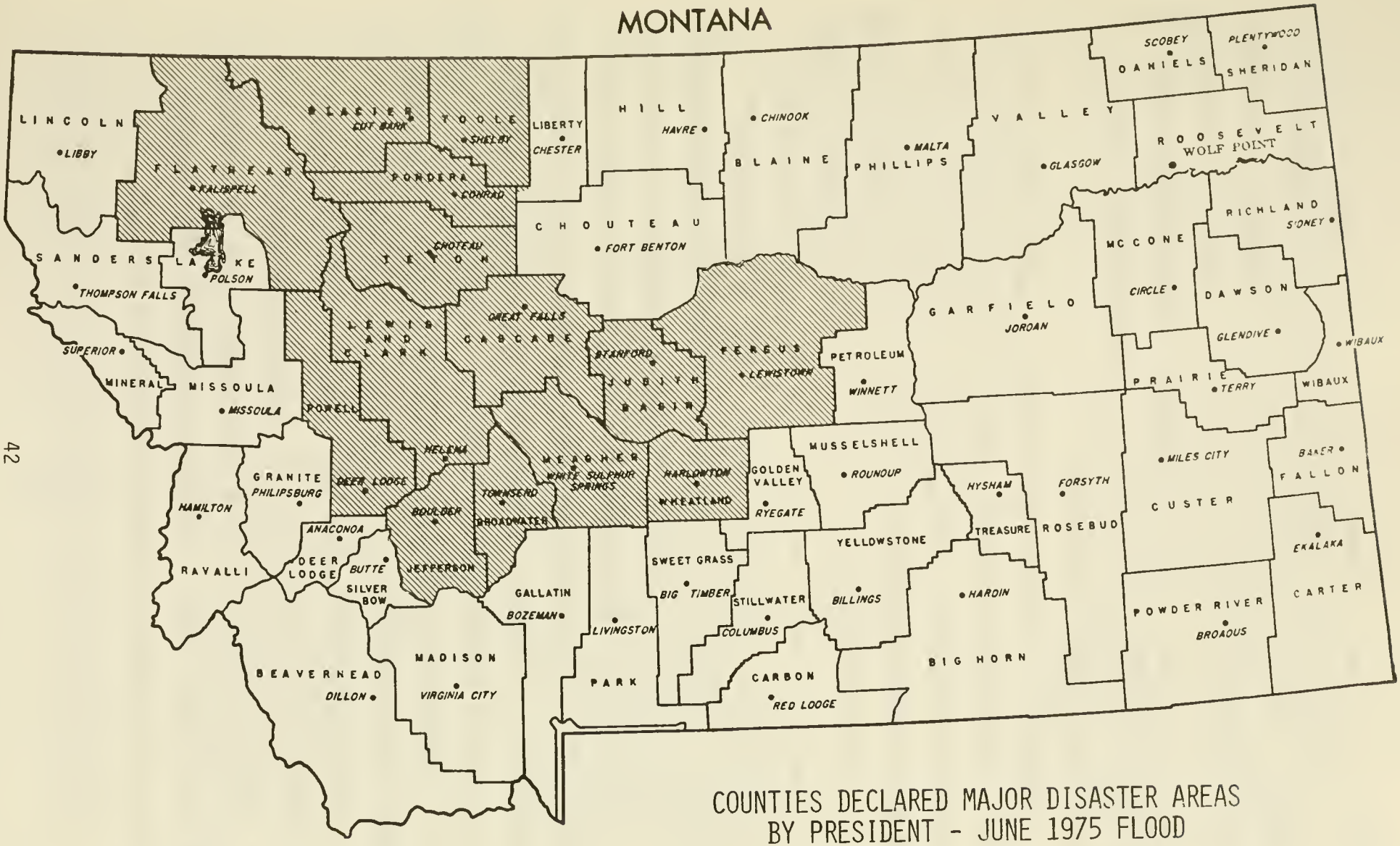
MONTANA



COUNTIES DECLARED MAJOR DISASTER AREAS BY PRESIDENT - JUNE 1975 FLOOD

FDAA-472-DR

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30,000 acres of land. Throughout much of its 18 mile length the canal traverses terrain which is up-slope from the City. At present there is no method of effectively controlling the flow in emergencies. Some water can be diverted into a stream west of Billings, but the main flow continues down the canal itself. It is estimated that 6 hours would elapse after the main intake valve is closed before the surface would lower 18" along the downstream portion of the canal.

A cloudburst in 1937 just west of the City caused an overflow of its banks, created a break and caused extensive flooding and damage in much of the City particularly in the downtown area. Currently the rimrock area just above this canal on the north edge of Billings has been sloughing off, causing large sandstone rocks to move down the slope toward the canal. On one occasion in 1974 a large rock, from this source, slid into the canal causing grave concern until removed. Corps of Engineers and Congressional representatives have been advised of the threat and asked to aid in correction of the threat; however, the problem still exists.

In the opinion of one representative of the Corps of Engineers at Fort Peck, Billings has a notable potential of serious flooding because of development and growth in the flood prone area. Livingston and Miles City can also be considered in this category. Because of excessive snow melt and rain some reservoirs and smaller earthfill dams have reached allowable capacity requiring spilling, but by the same token have relieved an annual flood problem. Yellowtail Dam, at Fort Smith on the southern edge of the Crow Indian Reservation has appeared to eliminate a large part of the Big Horn River flooding which ultimately fed the Yellowstone and caused greater problems in the Miles City-Glendive area. During spring run-off, storage of potential flood water in the numerous small

dams and reservoirs in all drainages is essential. Timely release of this water can have significant effect on downstream conditions. Systematic control of this release is highly important to receive desired benefits and yet avoid compounding problems in downstream areas.

Some hazard mitigation measures have been taken. Specifically adoption of the National Flood Insurance Program has been completed in (8) eight counties and (45) forty-five cities or towns. It is anticipated that zoning restrictions prohibing building in flood prone areas under this program will greatly improve flood loss records. Other measures such as Soil Conservation Service diking, Corps of Engineers projects to protect sewer and water systems, river bank erosion control and others have been initiated or completed.

At the request of the City of Billings, an extensive flood control project was designed by the Omaha District, Corps of Engineers[2], several years ago, for the Yellowstone Valley immediately west of the City of Billings. Up-dating has been done from time to time; however, the plan has not been approved and adopted. The determining factor in the decision to disapprove the proposal was the matching fund provision. Meanwhile land values in the area subject to condemnation continue to appreciate.

In 1975 the Soil Conservation Service provided an assessment of Emergency Watershed Measures for Montana in the sub-basins most seriously affected by the high water in June of that year. Recommended measures include: stream bank stabilization, multipurpose dams, diversion dams, clearing and snagging, stream channel stabilization and water control structures. The summary include an estimated cost of $34,222,910 as follows:

[2] Montana is served by the Seattle District, Corps of Engineers, west of the Continental Divide while the Omaha District, administered by the Fort Peck office is responsible for east of the Continental Divide.

Subbasin	Cost of Measures
Missouri Mainstem Tributaries	$ 1,091,540
Jefferson	66,815
Gallatin	72,335
Smith	599,765
Sun	4,740,540
Marias	12,892,190
Arrow	78,710
Judith	7,413,530
Musselshell	1,491,085
Milk	290,100
Yellowstone	2,647,845
Pend Oreille	2,703,455
St. Mary's	135,000
TOTAL	$ 34,222,910

Funding for these projects is anticipated under Section 216 of The Flood Control Act of May 17, 1950.

Annual flooding in recent years and continued stream bank erosion has contributed additional debris, adding to that already deposited throughout the flood prone area. Stabilization of stream banks and removal of debris become prime considerations to avoid build-up at bridge piers, culverts, irrigation diversions, etc. during future floods. The Corps of Engineers is the Federal Agency designated to accomplish diking and debris removal, but funding is adequate to support this category of work to a very limited degree. The problem persists at the local level where solutions must be found if this preventive work is to be accomplished to any appreciable extent.

A general summary of flooding effects within the State of Montana would support the conclusion that economic impact is the number one factor. Loss of lives has been minimal primarily because of the sparse population within the State and timely evacuation of inhabitants of threatened areas. The loss of lives in 1964 resulted from the sudden failure of the Swift Dam on Birch Creek, allowing no time for warning residents in the creek valley.

Losses in the public sector include damages to streets, roads, bridges and culverts, sewer and water systems and storm drains. Recreational areas and fish and wildlife habitats also suffer, resulting in reduction of income from sportsmen and tourists.

The impact of private homes, businesses, industries and other investments located in the flood plain is considerable. Valuable agricultural lands are being affected almost annually by lowland flooding depositing silt and debris, inundating crops, causing river bank and land erosion, loss of fences, disruption of irrigation systems and loss of livestock. With the State dependent upon agriculture as its major economic base these losses and disruptions become very significant.

State and local governments can assist potential victims in minimizing the effects of floods by disseminating information on:

1) Flood fighting techniques
2) River watches
3) Levee patrolling
4) Procurement and use of sandbags or substitutes
5) Diking methods and
6) Reporting essential information

This could be accomplished through local training seminars and workshops

in flood prone areas. Civil Defense exercises using a scenario portraying flood conditions have been effective vehicles for developing emergency operational capability of local authorities but more effort should be directed toward educating the general public.

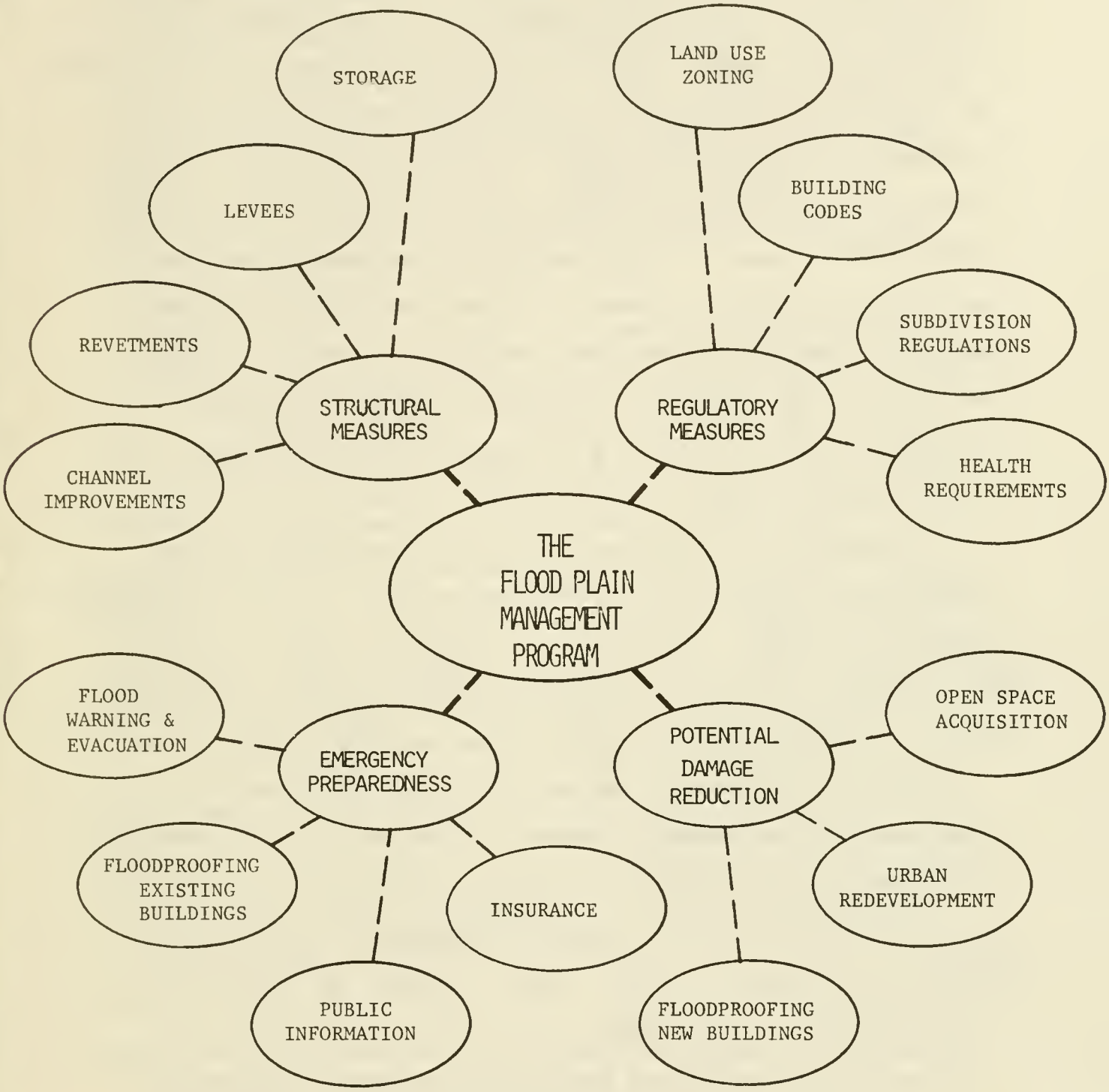
In planning for reduction of the destructive effects of floods provisions should be made for warning, for flood plan management and for research directed toward adoption of more effective protective measures.

Warning is based on such data as river flow forecasts by the National Weather Service, snow depth and water content measurements supplied by the Soil Conservation Service and direct observation (river watches) at the local level.

The National Weather Service Office, Great Falls, Montana, is responsible for forecasting unusual weather conditions for the State. Duties include reports of snowmelt, stream and river flow, guage readings, (visual and telemetered) temperature and precipitation forecasts. The River Forecast Center, Kansas City, consolidates reports and provides timely and accurate forecast information through the National Weather Service. By established policy this important information is disseminated through the National Warning System, United Press International and Associated Press along with seventeen radio stations within the State. In addition to Great Falls, district weather offices are located in Helena, Billings, Glasgow, Havre, Kalispell, and Missoula each with a National Warning System capability and established weather warning policy.

Flood plain management can be defined as development and controlled use of the flood plain based on comprehensive planning. This must be initiated at State and local levels. The diagram on Page 48 illustrates the major factors contributing to effective flood plain management.

ALTERNATIVE METHODS FOR REDUCING FLOOD DAMAGES



From Flood Damage Reduction Workshops, Co-sponsored by Association of Washington Counties, Department of Ecology, Washington State University Planning and Community Affairs Agency and Department of Emergency Services, State of Washington.

Some degree of planning has been done in many areas by State and local governments to alleviate loss of life and suffering from floods. Warning plans have been developed by local authorities assisted by State Civil Defense and Federal agencies which have contributed to reducing or eliminating the loss of lives in recent years. Certain agencies in all echelons of government are taking steps to assist in minimizing flood losses. Examples of this are: 1) The Montana Water Resources Board cooperating with several State and Federal agencies in development of a comprehensive water and land resources plan for the State, 2) A concerted effort by the Montana Department of Natural Resources, Water Resources Division, to introduce and assist with the adoption of the National Flood Insurance program throughout the State. This will bring about restrictive development in specific flood plain areas to reduce potential losses, 3) Efforts by the U.S. Department of Agriculture, Soil Conservation Service applying Emergency Watershed Measures to include bank erosion, 4) Corps of Engineers flood control projects, initiated by local governments, such as diking and debris removal, 5) Bureau of Reclamation efforts to improve conservation of water resources, improve irrigation systems and flood control systems.

During the period between 1936 and 1972 Federal expenditures for flood protection and prevention measures totalled over $9 billion nationally with Montana one of the recipients. These measures include land treatment in watersheds to abate runoff; engineering projects such as dams and reservoirs to regulate river flow, channel treatment, and diversion of flood waters out of certain areas.

Flood control measures have been supported by federal legislation specifically outlining certain authorizations and agency responsibilities. For example the Flood Control Act of 1944 and Flood Prevention Act of 1954

(Public Law 566 83rd Congress) authorized Watersheds anywhere in the nation up to 250,000 acres in size to be administered by U.S. Department of Agriculture. Exceptions are the Tennessee Valley and certain federal lands which are under the Department of Interior. Engineering Works are the responsibility of the Corps of Engineers under applicable laws and specific congressional authorities. Flood Plain Management is the responsibility of local and state government under the guidance of the National Flood Disaster Protection Act of 1973.

The Water Resources Act of 1965 authorized the formation of the National Water Resources Council and establishment of interstate commissions known as River Basin Commissions. Their function is to consider flood problems on a regional rather than a local basis working with states on a broader spectrum of water and land use control. The National Oceanic and Atmospheric Administration (NOAA), Department of Commerce, is charged with weather research. For example, two projects currently show promise. One involves creation of high-level cirrus clouds to reduce incoming radiation, thereby retarding snowmelt; the other is heavy seeding of cumulus clouds with artifical ice nuclei to reduce the amount of rainfall from them. The National Weather Service provides flood prediction, warning service, river forecasting and other services particularly covering river systems within the major basins. When all programs, projects, plans, resources and structures designed to control floods or mitigate their effects are considered the total of this effort is impressive. In spite of vast expenditures of manpower and funds, both public and private, the threat of floods remains.

Since damages from floods are limited principally to that portion of our environment in the flood plain which is either man-made or supports his existence the target is clearly delineated. Of the two elements involved

in floods - water and land - water is controlled principally by the Federal government and land by the State and local jurisdictions. The solution to flood problems lies in vigorous cooperative efforts by all levels of government.

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SECTION V

FOREST FIRES

FOREST FIRES

National Forest Lands

In the three years, 1973-75, fire suppression costs in the Northern Region of the U.S. Forest Service exceeded $33,567,331.00. A substantial portion of this expense occurred on forests within Montana. No estimate is available of the commercial value of the 58,000 acres of timber consumed by forest fires.

Based on figures such as these, it is clear that historically forest fires are second only to floods in damage potential. Since much of the economy of Montana is dependent upon the wood products industry, protection of the timber crop is vital.

REGION 1 FOREST FIRE STATISTIC [1].

Year	Class A	Class B	Class C+	Total	Light-ning Caused	Man-Caused	Acres Burned In N.F. Area	Acres Burned in Protected Area	Cost of Suppression
1960	948	369	72	1,389	1,003	386	16,705	18,509	5,319,785
1961	1,868	408	96	2,372	2,055	317	57,369	63,474	11,525,314
1962	960	205	24	1,189	912	277	3,038	3,302	1,983,303
1963	1,574	260	47	1,881	1,583	298	4,201	5,162	3,097,660
1964	643	130	24	797	567	230	1,258	1,560	1,338,344
1965	610	82	17	709	548	161	548	667	863,467
1966	1,216	261	87	1,564	1,236	328	33,714	35,358	5,220,120
1967	1,355	401	95	1,851	1,426	425	60,447	83,555	21,359,742
1968	618	158	42	818	537	281	6,946	8,680	3,030,724
1969	643	194	38	875	469	406	2,615	3,102	3,104,778
1970	1,446	276	96	1,818	1,416	402	16,687	18,450	8,612,826
1971	798	196	46	1,040	687	353	5,009	8,320	5,618,818
1972	1,062	192	26	1,280	1,007	273	1,839	2,294	4,912,711
1973	1,366	345	95	1,806	1,253	553	16,687	28,151	16,658,425*
1974	1,129	253	55	1,437	842	595	4,997	7,254	10,781,638*
1975	483	85	9	577	392	185	391	592	6,127,268*

* Due to change in interregional transfer of fire fighting funds, this figure does not include use of Regional crews, equipment and aircraft not paid through Region 1.

1. From U.S. Forest Service, Region 1 Reports.

State and Private Lands

Of the approximately 12½ million acres of State owned and private forest land in Montana only 8½ million acres receive adequate fire protection. Protection for the other 4 million acres is below standard.[2] The total timber resource at risk in Montana was valued at $2,257,848,504.00 in 1972. In analyzing potential loss from forest fires on State and private lands other resources at risk cannot be ignored.

VALUES AT RISK DATA FOR MONTANA

Timber	$2,257,848,504
Water	621,374,706
Recreation	930,809,356
Wildlife	267,106,088
Forage	822,259,903
Real & Personal Property	456,798,253
TOTAL IN 1972 -	$6,106,064,363

Over 500 fires are reported annually on the 8½ million acres of forest land under protection. The number of fires on the unreported 4 million acres would swell this total significantly. Approximately 50% of the reported fires are man-caused and the other 50% are lightning ignited. At present, there is no control over the lightning ignitor.

[2] From State Forestry Division Reports

STATE AND PRIVATE FOREST LANDS [2.]

STATISTICS 1972 - 73 - 74 CALENDAR YEARS' AVERAGE

8,352,529 Acres Protected

A. FIRES BY CAUSES

CAUSE	NO. OF FIRES	%	ACRES BURNED	%
LIGHTNING	262	48.4%	5,657	72.6%
CAMPFIRES	51	9.4	64	0.8
SMOKING	38	7.0	259	3.3
DEBRIS BURNING	42	7.8	930	11.9
INCENDIARY	15	2.8	42	0.5
EQUIPMENT USE	21	3.9	666	8.5
RAILROADS	45	8.3	53	0.7
CHILDREN	36	6.7	18	0.2
MISCELLANEOUS	31	5.7	110	1.5
TOTAL	541 PER YR.		7,799 ACRES PER YEAR	

B. THREE MAJOR CAUSES UNDER MISCELLANEOUS:

1. BURNING BUILDINGS — 9 TOTAL - 3/YR. Average
2. POWERLINE — 5 TOTAL - 1+/YR. Average
3. ELECTRICAL SHORTS — 5 TOTAL - 1+/YR. Average

C. SIZE CLASSES FIRES:

CLASS	NO. OF FIRES	%	ACRES BURNED	%
CLASS A .25 ACRES	394	72.8%	---	---
CLASS B .26 TO 9 AC.	120	22.2	255	3.3%
CLASS C 10 TO 99	19	3.5	552	7.1
CLASS D 100 TO 299	2	0.4	369	4.7
CLASS E 300 TO 999	4	0.7	1,795	23.0
CLASS F 1,000 TO 4,999	1	0.2	1,175	15.1
CLASS G 5,000 AC. +	1	0.2	3,653	46.8
TOTAL	541 PER YEAR		7,799 ACRES PER YEAR	

For planning and budget purposes the U.S. Forest Service defines the fire season as July 1 through September 15, with the peak danger anticipated around August 15. In May and June there is usually sufficient moisture in forest fuels to keep the burning rate within controllable limits. Approximately every sixth year, when fall rains are delayed, extreme fire danger persists into November.

[2.] From State Forestry Division Reports

The highest concentration of forest lands occurs in the Western and Southwestern part of the State; (Map Page 57) however, even sparsely timbered areas and relatively small patches of trees can become points of origin of disastrous fires. Although firefighting techniques vary between mountainous and prairie landscapes, this distinction is not the overriding consideration. Potential loss of life, injury and economic loss is of prime importance. When closure of all or part of the forest area is warranted by extreme fire danger conditions, the economic effects are widespread. These include unemployment due to curtailment of logging operations, exodus of vacationers and general reduction of travel and activity.

In addition to the timber stands themselves, problems associated with forested areas include:

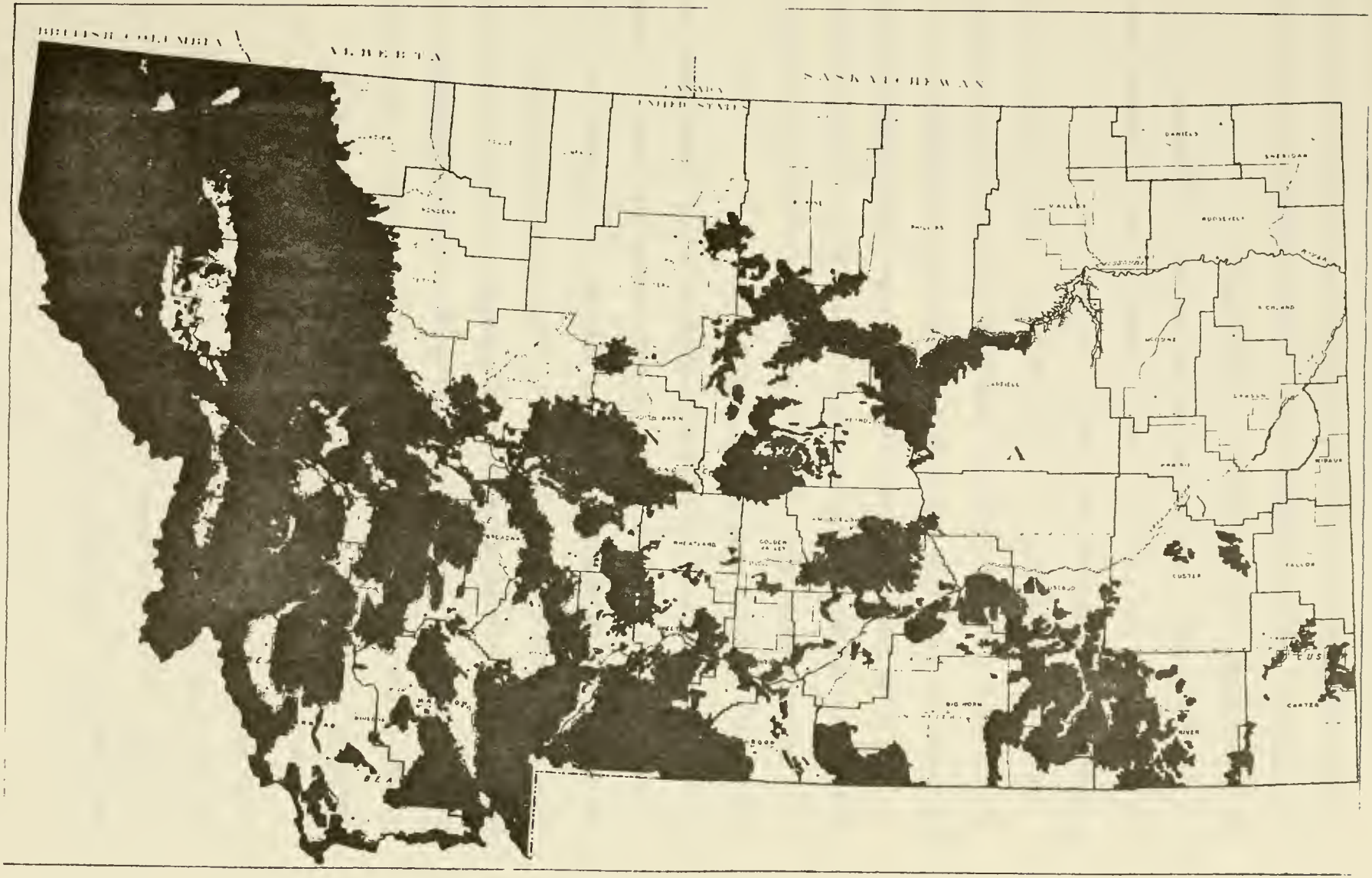
Slash & Fuel Buildups--Cutting on private lands has increased with a corresponding increase in slash debris on the ground. Much of this fuel, in our dry climate, will remain a potential hazard for years.

Homesites--The forest atomosphere continues to attract many suburban and rural home builders. Water supplies, fuel breaks, access roads, etc. for fire suppression are basically inadequate. The sheer number of homes has added a significant human risk to the forest area. It will be hard to keep man-caused fire starts at its presently low level in the future.

Entire Communities--Communities surrounded by forest are vulnerable, especially under extremely hot, dry conditions when spot fires can occur far ahead of a fire front. Seeley Lake in Missoula County, Thompson Falls in Sanders County, and West Yellowstone in Gallatin County enjoy beautiful forested settings but all have experienced at least one alert necessitated by the proximity of forest fires. The potential for disastrous fires in and around such communities is greatly increased by the influx of thousands of summer visitors taking advantage of the recreational advantages there.

The black areas on this map indicate the forest land areas in Montana classified for forest fire protection by the State. In addition to the federal ownerships, the classified areas include 12,527,469 acres of State and privately owned lands.

1965



Since fires, like most disasters, are not confined by administrative boundaries two or more jurisdictions are often involved in fire suppression. In respect to the area under protection, this problem has been solved to an appreciable extent by the following agreements:

1) The State Forestry Division has entered into Cooperative Fire Control Agreements with 19 counties. These agreements cover equipment, training, supervision, regulations and funding.

2) The State Forestry Division, the U.S. Forest Service, The Bureau of Indian Affairs and the Bureau of Land Management also have entered into agreements to establish cooperative operational relationships.

3) In at least one county the U.S. Forest Service and County Fire Departments divide responsibilities to more effectively cover a rural area.

These agreements are a necessary feature of effective fire control; however, they do not apply to unprotected areas.

Another type of agreement is designed to attain suppression capability without having to support a fully manned and equipped force in standby status. The State Forestry Division contracts with the Montana National Guard for such specialized resources as field kitchens and crews, 2½ ton 6X6 trucks, helicopters and radio-equipped ground support vehicles. The U.S. Forest Service, Bureau of Indian Affairs and Bureau of Land Management also request National Guard support under the terms of this contract, titled The Annual Operating Plan. Again, these provisions cover protected lands only.

There is need, then, to extend protection to the 4 million acres of State owned and private forest land now inadequately protected. Under present State laws the private landowner pays a direct assessment for such protection. This requirement has made it almost impossible to enlarge the protected area. The Legislative Council is preparing bills which, if adopted,

will remove legislative barriers to accomplishment of the desired goal.

Other measures to reduce hazards include controlling slash burning, insuring that building permits for homes and subdivisions in forested areas provide for adequate water supply, fuel breaks and access roads and increasing public awareness of the devastating effects of fires.

A limiting factor in maintaining an adequate fire suppression capability at State level is the extent of Federal support. Under the Clark-McNary Act of 1962, the States have received annual payments for fire control purposes based on demonstrated need and actual expenditures. In recent years the Federal government has made a concerted effort to hold funding at a constant dollar level. Ten years ago this amounted to approximately 45% of the total expended through the State Forestry Division. Currently it is running at about 14%. This does not equitably prorate costs on the basis of the tax benefits derived from logging operations, recreational activities and other businesses in timbered areas.

Regardless of the effort expended and the techniques applied, forest fires will continue to cause much havoc and economic loss in Montana. Thoughtfull planning can contribute substantially to reducing the widespread effects of these costly natural disasters.

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Richard Sandman, Chief, Fire Bureau, Forestry Division, Montana Department of Natural Resources and Conservation.

SECTION VI

HAZARDOUS MATERIAL ACCIDENTS

HAZARDOUS MATERIAL ACCIDENTS[1]

A list of the major hazardous materials manufactured, transported, or stored in Montana include:

Agricultural chemicals-insecticides, herbicides and rodenticides

Explosives and ammunition

Petroleum products-gasoline, liquid petroleum gas, natural gas, fuel oil, etc.

Radioactive materials-original and waste

Agricultural Chemicals

Shipment of chemicals, insecticides and herbicides are transported interstate as well as intrastate by rail and motor transport. Insecticides which are currently used in every section of the State are considered hazardous. The bulk of these insecticides are used in the Flathead Lake area, Gallatin River drainage and Yellowstone River drainage.

Herbicides are not considered too hazardous although they could contaminate irrigation water by misapplication.

A disposal problem exists with 72 tons of solid and liquid chemicals which was taken off the market in 1968 and 1969. These consist of insecticides, herbicides, fungicides, rodenticides and many other toxic or poisonous materials. Currently these products are stored at Glasgow Air Force Base. The State government proposes to bury this in deep pits when suitable land can be acquired.

Explosives and Ammunition

Explosives are used mainly in two work areas in the State (1) mining and (2) construction sites. The heaviest concentration of explosives would be in

[1] (Refer to maps "Interstate, U.S. and State Numbered Roads", Page 89, "Railroads", Page 92 and "Airports Served By Scheduled Airlines", Page 95 which are part of the "Transportation Accidents" section of this analysis.

Butte area with the Berkley Pit. Smaller mining operations are quite common in the Western mountainous area of the State. Construction sites throughout the State also use explosives.

Explosives used in mining and at construction sites are transported, principally by motor transport. Although many of these sites are in rural areas movement of this material along major travelled highways and through congested areas constitutes a hazard for consideration. Similarly, transportation of ammunition adds a certain degree of risk.

Petroleum Products

The map on page 63 graphically shows the location of oil and gas fields, pipelines, refineries and gas plants within Montana.

At the present time there is no petroleum or gas production west of the Continental Divide. The majority of the oil production is in Glacier, Toole, Sheridan, Roosevelt, Richland, Fallon, Powder River, Golden Valley and Musselshell counties with major refineries in Cut Bank, Shelby, Great Falls, Billings and Laurel. For the most part Great Falls distributes refined products to Sinclair, Wyoming, Livingston, Helena, Spokane and points enroute. Also northeast to Williston, North Dakota and points enroute.

The largest gas production is in Glacier, Hill, Blaine, Toole and Phillips counties. This gas is distributed by pipeline as shown on the map on page 63. Although there have been no serious disasters, there is a potential due to the length of pipelines carrying refined fuels and natural gas.

Some cities and communities in the State are concerned over the temporary loss of their natural gas supply during extremely cold weather

EXPLANATION

OIL FIELD (Pr Pl = Prorated, Pl = Plugged, In Pl = Not Producing)
GAS FIELD
OIL PIPELINE
GAS PIPELINE
REFINERY ▲ GAS PLANT ▲
REFINED PRODUCTS PIPELINE - - - -
BOUNDARY DIVIDING NORTHERN AND SOUTHERN DISTRICTS

★ Billings - Southern District & Technical Office
★ Shelby - Northern District Office
★ Helena - Administrative Office

MONTANA
OIL AND GAS FIELDS, PIPELINES AND REFINERIES
1972
BOARD OF OIL AND GAS CONSERVATION

because they are served by only one pipeline. For instance, if this should happen in Great Falls, all pilot lights would go off and it would require a minimum of three days eventhough the line was repaired immediately to restore service to homes, since each home must be inspected for safety and making sure the pilot lights are re-lit.

The transportation of oil and refined products through pipelines presents a hazard which could cause severe damage from fire and pollution. One example of what could happen is an incident in Missoula on September 17, 1973. An employee, at one of the bulk storage plants, misread a meter on a large storage tank. The contents guage read 26 feet 3½ inches and was misread as 16 feet 3½ inches. Replenishment was ordered from the Billings Control accordingly. The valve was turned on in Billings and before the mistake could be reported the overflow of gasoline (approximately 20,000 gallons) spread over a large area in an industrial complex. Thirty-six fireman and 8 fire trucks reported to the scene and covered the gasoline spill using 31-5 gallon cans of foam concentrate. Traffic was halted, trains were stopped, aircraft directed to avoid the scene and people evacuated. Luckily the fuel did not ignite. Controls have since been instituted which should prevent a recurrence of such accidents at this particular location.

A considerable volume of gasoline and diesel oil moves over the highway system in tank trucks. One accident, on the east shore of Flathead Lake involving a tank truck, resulted in a costly fire which destroyed the truck, a home, and much equipment. In June of 1976, as a result of a tank truck accident, oil spilled into Hungry Horse Reservoir creating a water pollution problem.

Radioactive Materials

There are daily shipments of radioactive materials through the State although no estimate can be made of the number of shipments moving at any one time. Most shipments are made by motor freight, many by rail, some by private carrier (used by oil industry) and a minimum shipped by air.

Major users of these products are:

1. The medical profession, for tracers (low density) and x-rays.
2. Hospitals providing cobalt treatments require a product up to 8000 curies.
3. The U.S. Forest Service, for moisture density guages.
4. The oil industry for tracers in refineries and pipelines and for logging wells. In this process alpha and gamma rays are used to determine the characteristics of the formations encountered.

Naturally the radioactive materials required within the State account for only a fraction of the amount which is moved interstate. The Rocky Mountain Arsenal, in Denver, is a repository for research materials resulting in shipments to and from Denver and many of these shipments move into and out of Montana over Highway I-15 and the Union Pacific Railroad. The shipments consist of both radioactive materials and radioactive waste. Shipments naturally are moved interstate over Highways U.S. #2 and I-90-94 as well as over both east-west routes of the Burlington Northern and Milwaukee railroads.

Malmstrom Air Force Base continually moves missiles and radioactive materials to and from the Base to missile sites located in Cascade, Teton, Pondera, Glacier, Lewis & Clark, Judith Basin, Fergus and Wheatland counties. These are transported over interstate, State, and county roads. This presents

a definite hazard. At least one missile truck was involved in an accident with no serious consequences.

In recent years two radiological accidents occurred on railroads in western Montana. In one case, near Missoula, a fire originating from a hot box ignited the floor and cargo of a box car containing a shipment of radioactive pellets. The pellets spilled out of the burned boxes necessitating special handling by a technically trained crew from the Atomic Energy Commission (now the Nuclear Regulatory Commission). In the other case, near Deer Lodge, a tank car carrying liquid radioactive waste was derailed and came to rest at a precarious angle. Although the seams did not rupture the incident caused concern in the local area. Agencies involved, in addition to the railroad, include Powell County Civil Defense, The Montana Highway Patrol, County Sheriff Department, The State Department of Health and Environmental Sciences and the Nuclear Regulatory Commission. The car remained on a siding in Deer Lodge for approximately a week before authorities cleared the cargo for continued transit.

Montana has been quite fortunate in having relatively few hazardous material spills and radiological accidents considering the mileage and traffic over highways, railroads, pipelines and airways. However, those that have occurred should serve as fair warning of the potential. Each case is unique, depending upon nature of the product, physical circumstances of the accident, weather conditions, and other variables. Accidents of the type generate a need for immediate action by responsible agencies to minimize destructive effects.

The following chart indicates actions required by response agencies:

Response Agencies

	Shipper	Carrier	Nuclear Reg. Comm.	Law Enf.	Civil Defense	State Dept. of Health	Military
Requirements							
Identification	X	X			X		
Characteristics	X		X			X	
Isolation				X			
Security				X			X
Monitoring					X		
Disposition	X	X	X			X	

Safe handling of hazardous materials demands rapid response by knowledgeable technicians supported by Civil Defense and security forces in a closely coordinated effort. Also there is a need for continued close control of shipments into and through the State. The State Department of Health and Environmental Sciences maintains an inventory of products and their formulas although the proliferation of brand names and continual expansion of uses of chemicals complicates this activity. General familiarization with procedures for handling toxic materials is not attainable. Knowledge of where to go for help is essential.

Hazardous material accidents are accidents that require special handling and response. These accidents also require highly trained emergency response teams and the training of these teams is most important. Presently the Civil Defense Division, Montana Department of Military Affairs, is conducting

a hazardous material accident class in several cities in the State and it is recommended that all people involved in handling hazardous materials and all organizations with emergency response responsibilities attend this class.

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SECTION VII

INSECT INFESTATION

INSECT INFESTATION

The agricultural economy of the State can be affected by several natural disasters, one of which is insect infestation. Past history in the State reflects that grasshoppers are the primary insects which affect the agricultural economy of the State. The following chart depicts the acreage in the counties by year that was infested with grasshoppers.

Grasshopper Infestation

1964-1969

Year	Counties	Acreage
1964	Blaine	157,116
	Big Horn	
	Rosebud	
1965	Big Horn	385,109
1966	Big Horn	555,245
	Rosebud	
	Yellowstone	
1969	Rosebud	35,072

Since 1974 the grasshopper population has been increasing in the State. A survey of range land by the Animal and Plant Health Inspection Service of U.S. Department of Agriculture in 1974 and 1975 shows this increase. The following chart depicts the number of acres infested with 8 or more grasshoppers per square yard.

Rangeland Grasshopper Infestation

in Montana

Acreage - Fall of 1974 & 1975

Year	Private	Public	Total (Acres)
1974	720,420	792,900	1,513,320
1975	5,070,200	1,547,300	6,617,500

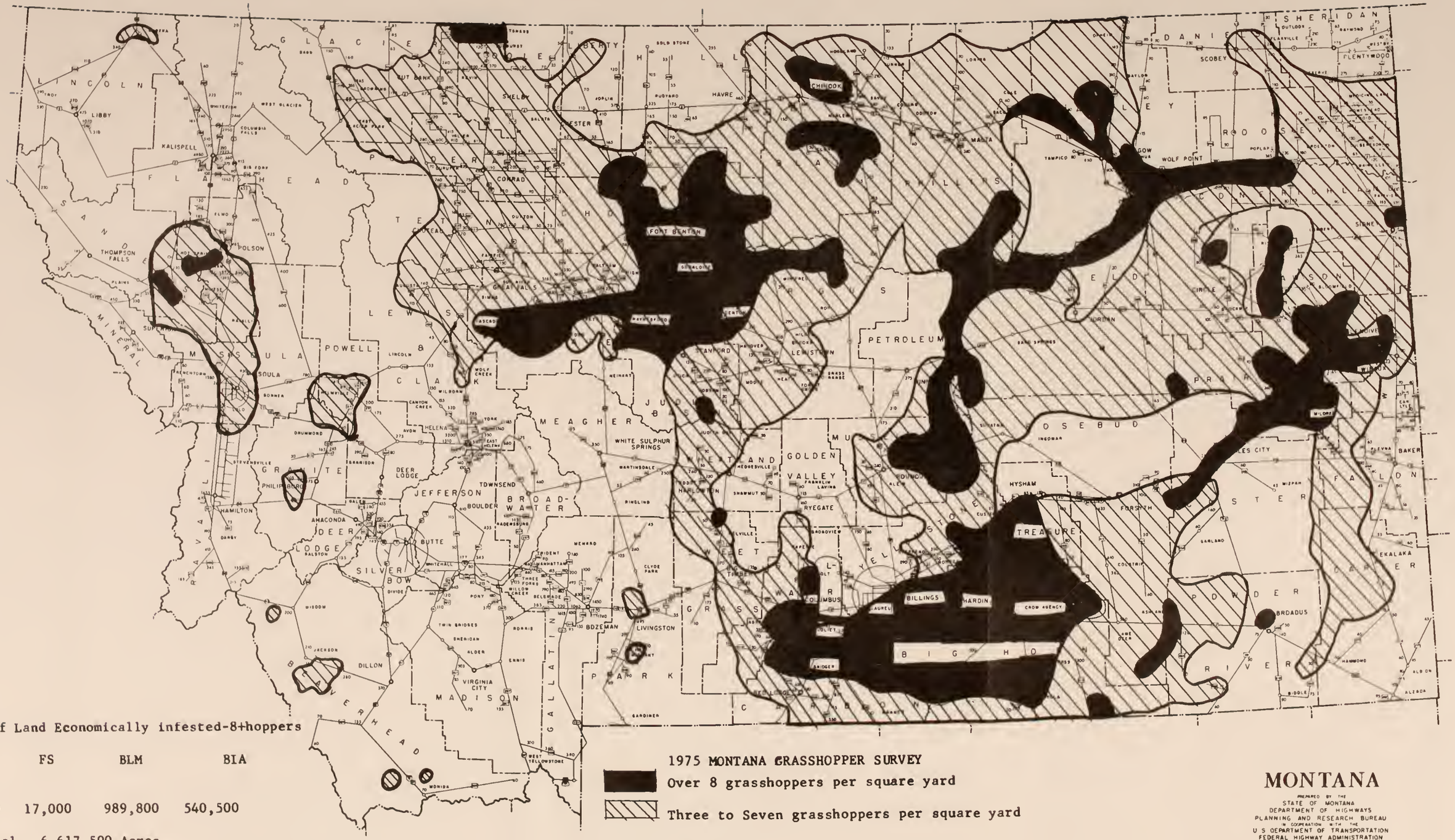
The map on page 72 reflects the results of the 1975 survey. This map is based upon the results of cooperative grasshopper adult surveys made during the late summer and fall of 1975. The survey reveals where and how many grasshoppers infest an area and indicates the potential severity of infestations for 1976. Nymphal surveys, made in the spring, determine population densities and indicate those areas where control may be necessary in 1976.

Basically, the grasshopper infestation problem runs in cycles. Normally the cycle will peak every 9 to 10 years, depending on the weather. If, for example, the State has an extended dry spell, the grasshopper population increases. The 1975 survey indicates that the State is now at the peak of this cycle.

The control of the grasshopper poses a unique problem. Spraying the infested area has proven to be the most effective means. To obtain the most effective kill, the spraying must be done after the normal spring hatch and before the adults begin depositing their eggs.

To adequately control the grasshopper infestation in the State, a continued yearly survey is necessary. When the survey indicates the cycle is reaching its peak a joint effort of the farmer/rancher with State and Federal support can spray the infested areas.

The Animal and Plant Health Inspection Service states that the Mormon Cricket is the second most troublesome insect common to Montana. While the cycle of infestation is less frequent damage is typical of the grasshopper affecting grasses and crop lands specifically.



Acres of Land Economically infested-8+hoppers

Private Land	FS	BLM	BIA
5,070,200	17,000	989,800	540,500

Grand Total 6,617,500 Acres

1975 MONTANA GRASSHOPPER SURVEY

Over 8 grasshoppers per square yard

Three to Seven grasshoppers per square yard

MONTANA

PREPARED BY THE
STATE OF MONTANA
DEPARTMENT OF HIGHWAYS
PLANNING AND RESEARCH BUREAU
IN COOPERATION WITH THE
U S DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

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SECTION VIII

RANGE FIRES

RANGE FIRES

Range fires have consistently been a problem of major concern to many counties in Montana during the heat of the summer and fall following heavy spring and early summer forage growth. In addition, Federal lands, State lands and Indian Reservations under the supervision of the BIA experience major problems within or adjacent to local government boundaries.

Written or verbal mutual aid agreements between levels of government are essential when the capacity of the jurisdiction to cope with an extensive fire is overtaxed.

It is generally agreed that the expansion of living in rural areas, development of remotely located lands for home use, permanently established residences or summer homes, is compounding the threat to more lives as well as high value property. The expansion also contributes to a higher rate of incidents with more persons scattered throughout a wider area contributing to more man caused fires.

Each of the following agencies or governmental units have certain capabilities to contain or suppress fires depending upon location and magnitude:

1. Counties

Extensive planning to expand and improve county rural fire control has been underway in most of the 56 counties within the State. Their Civil Defense agencies have aided in procuring a variety of fire control equipment from several sources. Items from military excess fire trucks to communications equipment have been procured. Vehicles such as pickups, utility trucks, two and one-half ton trucks and tank trucks have been procured and converted by the counties into excellent fire control vehicles. Rural fire councils operate in many counties in support of active volunteer fire departments and

county fire districts. Mutual aid agreements have been signed between all counties in the State and in many cases implemented effectively to reduce fire loss.

2. State Forestry Division

The State Forestry Division is extremely active throughout the State promoting efficient fire control particularly in those counties having State forest land. Much progress has been made by this department toward getting counties to implement the small mill levy which in turn brings State assistance to include permanently located equipment at strategic points within the county. This equipment is available at no cost for the units to the county for general county fire control as well as protection to State forest lands. This not only compliments the county equipment for range fire fighting, but brings State Forestry aid which in turn protects their forest land.

The State Forestry Division advises "that there are 50 million acres of range and crop lands in Montana of which 20 million acres receives adequate fire protection. The other 30 million acres are protected below standard. The potential resource loss has not been calculated but would be enormous."

There are two major sources of range fires, lightning and man caused which includes transporation. Range or grass fires move into forest lands and vice versa. This is where the mutual aid assistance is invaluable.

3. Bureau of Land Management (BLM)

A large and important arm of the Federal government with excellent manpower and other resources to control range fires in the BLM. With jurisdiction over about 8,150,000 surface and 38,000,000 subsurface acres their responsibility covers a wide area of Montana. As a result, they have placed crews and equipment in strategic areas plagued by lightning and occasional man caused fires. During the summer and fall fire season,

approximately 100 persons are employed and placed in these areas, along with pumper trucks, fire caches, helicopters and fire retardant aircraft. These strategic areas are basically: Missoula, Dillon, Helena, Lewistown, Zorman, Billings, Otter and Miles City.

BLM efforts augmented by county and State planning and resources add greatly to more efficient control of major fires. BLM records show 2 range fires of 5000 acres or more called the 7-W fire and the Moorhead fire in the Miles City District. The Blood Creek fire of over 25,000 acres in the Lewistown, District, the Sieben fire and Spokane Hills fire in the Missoula District. These were all major fires affecting livestock, wildlife and timber with a profound economic impact. Mutual aid agreements also exist between Federal agencies for this and other emergencies. Under authority of the Federal Property and Administrative Services Act of 1949 as amended, a comprehensive fire control agreement has been established between the Bureau of Land Management and the State of Montana.

4. Bureau of Indian Affairs (BIA)

A fourth and equally important resource is the BIA. Because of the wide range of responsibilities carried by the staff and support personnel of this government entity, they are particularly responsive in a number of areas and notably fire control. Since the 7 Indian reservations encompass a vast amount of land, 7,000,000 acres, with the majority located as grass or grazing lands, the BIA is vitally concerned with adequate fire control capability. The protection area is over 9,000,000 acres. Records show approximately 200 fires per year. The majority of these are considered small. About 5 per year would be 100 acres or more. Losses in life and property have been minimal but timber, range and crop losses have run from tens to several thousands of dollars in a normal year. Two lives have been lost in the past

10 years and occasionally a home is caught in a range fire.

Co-op agreements have been signed between the BIA and local governments as well as other Federal agencies. Such agreements are established as well, with appropriate State agencies. Contract usage of aircraft by BIA is also authorized during fire season. Interviewees indicate planning is to be broadened to cover health care units, heavy equipment and aircraft units as well as housing and feeding on a temporary basis.

One of the most recent significant fires was near Fort Peck, Montana, involving the town of Oswego in 1972, totally wiping the community out of existence. This was a typical range fire fanned out of control with high winds. Range, homes and businesses were burned.

Stocks of materials are available in a pre-designated area at the Boise Interagency Fire Center, Boise, Idaho, and can be procured in a matter of hours. This includes complete radio units, emergency power and other items used for this purpose. Radio units are compatible with existing units and assigned Indian frequency. Mobiles include tribal law enforcement.

The map on page 78, outlines the seven reservations located in Montana, showing reservation irrigation projects, Indian population figures and location and ownership of land on the reservations. The map on page 79, indicates potential BIA water storage sites. Specially trained Indian fire control crews are on constant alert during fire season and can be utilized by Federal agencies having a fire control responsibility.

Interview data relative to this analysis supports the fact that local governments and support units indicate strongly that range fires rate second or third as the State's most likely prospect for an emergency in a large number of the communities.

To develop effective control over range fires, efforts should be directed toward extending protection over the 30 million acres now inadequately protected.

INDIAN RESERVATIONS
MONTANA AND WYOMING

IRRIGATION DEVELOPMENTS AND STATISTICS

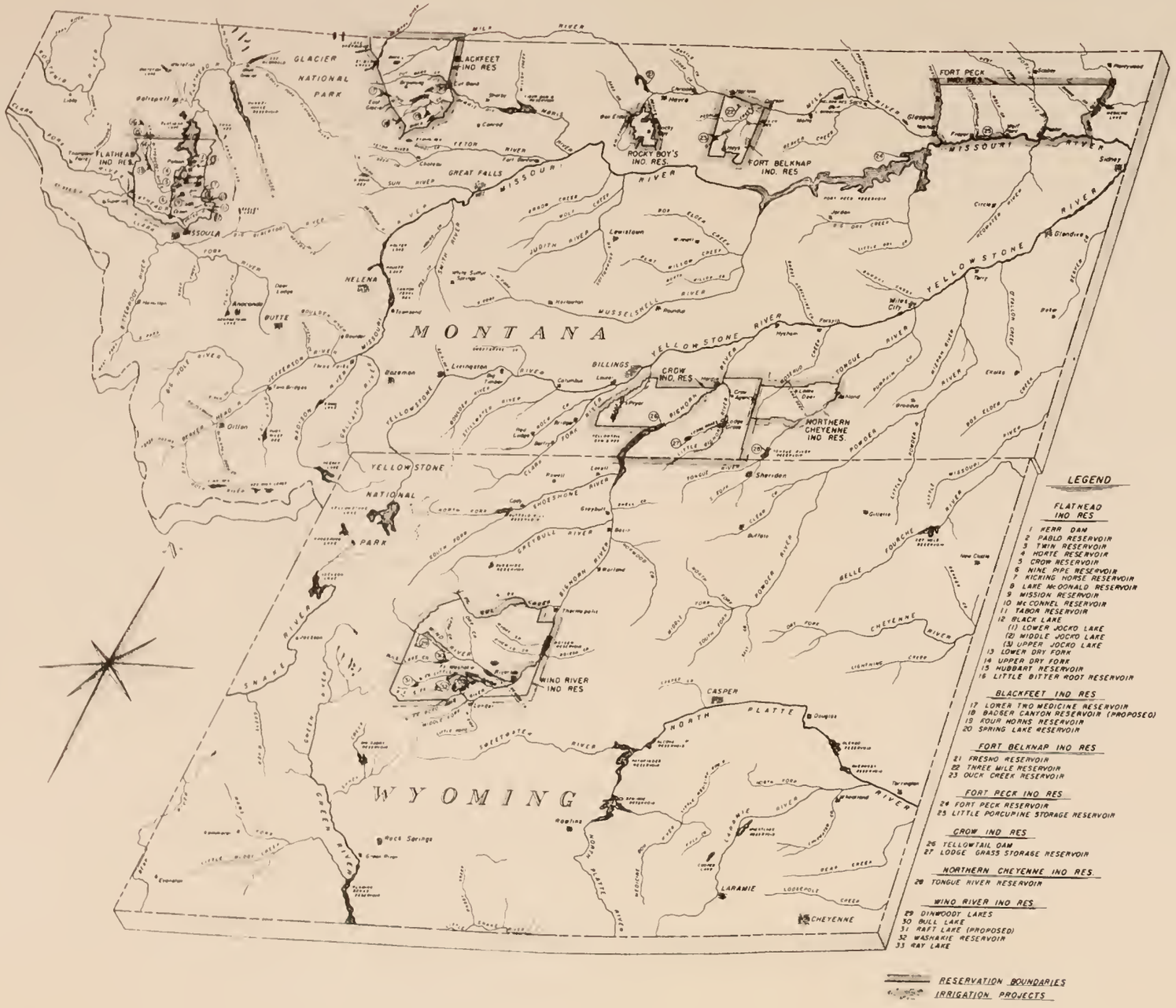


TABLE I

INDIAN IRRIGATION PROJECTS - MONTANA AND WYOMING

RESERVATION	Total Acres	Date irrig system authorized	Present project acres ☆	Percent of total reservation area	Acres to be developed	Percent of total reservation area	Ultimate development acres	Percent of total reservation area	Percent of irrigation project completed
BLACKFEET	1,525,712	1907	40,318	2 66	13,986	0 92	54,304	3 57	74 3
CROW	2,282,764	1910	37,387 ☆☆	1 64	8,297 ☆☆	0 27	43,684 ☆☆	1 91	85 8
FLATHEAD	1,840,000	1910	110,720	8 92	10,780	0 88	121,500	9 79	91 1
FORT BELKNAP	651,119	1894	10,307	1 61	2,746	0 42	13,253	2 05	79 3
FORT PECK	2,093,184	1908	12,436	0 60	12,189	0 58	24,625	1 18	50 3
NORTHERN CHEYENNE ☆☆☆	444,157	1932	756	0 16	—	—	756	0 16	—
ROCKY BOY'S	107,511	—	—	—	—	—	—	—	—
Total - MONTANA	8,344,387		212,324	8 54	45,398	0 53	258,322	3 09	82 2
WIND RIVER - WYOMING	2,268,008	1894	38,994	1 72	16,418	0 72	55,412	2 44	70 4
Total reservations - Billings Area	10,612,395		251,318	2 37	62,416	0 59	313,734	2 96	80 1
TURTLE MOUNTAIN	87,372	—	—	—	—	—	—	—	—
Total - Billings Area	10,699,767								

☆ Area Assessed
☆☆ Two Loggine and Bozeman Trail not included
☆☆☆ Project not active

TABLE II

INDIAN POPULATION - BILLINGS AREA - MONTANA AND WYOMING

January 1, 1967

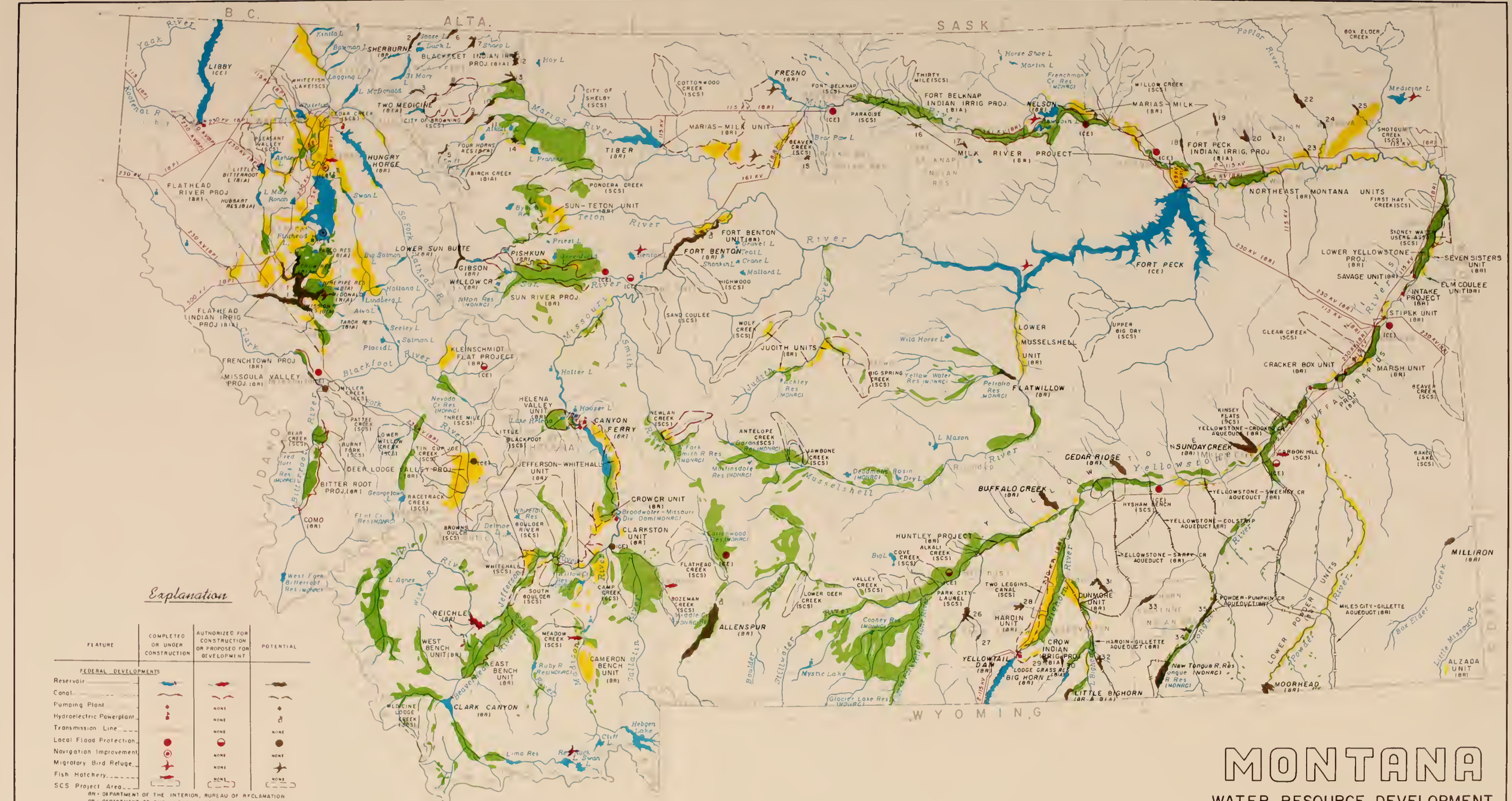
RESERVATION	Date Established	Tribe	Estimated Living on reservation	Estimated Living off reservation	Percentages Male	Female	On	Off	GRAND TOTAL
BLACKFEET	1851	Blackfeet	5,804	4,663	49%	51%	55%	45%	10,467
CROW	1851	Crow	3,405	1,527	51%	49%	69%	31%	4,932
FLATHEAD	1855	Confederated Salish and Kootenai	2,847	2,513	49%	51%	53%	47%	5,360
FORT BELKNAP	1888	Assiniboine and Gros Ventre	1,836	1,921	50%	50%	45%	55%	3,557
FORT PECK	1888	Assiniboine and Sioux	3,078	2,596	51%	49%	54%	46%	5,674
NORTHERN CHEYENNE	1884	Northern Cheyenne	2,335	666	50%	50%	77%	23%	3,001
ROCKY BOY'S	1918	Chippewa Cree	1,002	484	46%	54%	67%	33%	1,686
		MONTANA TOTAL	20,107	14,370	49%	51%	58%	42%	34,477
WIND RIVER	1868	Arapahoe	2,310	366	51%	49%	86%	14%	2,676
		Shoshone	1,403	580	49%	51%	65%	35%	1,983
		WYOMING TOTAL	3,713	946	50%	50%	79%	21%	4,659
		BILLINGS AREA TOTAL ☆	23,820	15,318	49%	51%	60%	40%	39,136

☆ Turtle Mountain not shown

TABLE III

LOCATION AND OWNERSHIP OF LAND ON INDIAN RESERVATIONS IN MONTANA AND WYOMING

STATE	RESERVATION	TRIBE	Date Established	Reservation Area - Acres	Indian-owned Ac.	Percent	Gov't-owned Ac.	Percent	Non-Indian owned Ac.	Percent
MONT	BLACKFEET	Blackfeet	1851	1,525,712	945,038	61 94	14,018	0 92	566,656	37 14
MONT	CROW	Crow	1851	2,282,764	1,375,475	69 03	1,096	0 04	706,193	30 94
MONT	FLATHEAD	Confederated Salish and Kootenai	1855	1,840,000	818,698	49 89	2,244	0 19	819,058	49 92
MONT	FORT BELKNAP	Assiniboine and Gros Ventre	1888	651,119	597,153	91 71	25,538	3 92	28,434	4 37
MONT	FORT PECK	Assiniboine and Sioux	1888	2,093,124	898,113	42 91	85,398	4 08	1,109,819	53 01
MONT	N CHEYENNE	Northern Cheyenne	1884	444,157	434,277	97 78	1	—	9,879	2 22
MONT	ROCKY BOY'S	Chippewa Cree	1916	107,511	107,511	100.00	—	—	—	—
		TOTAL - MONTANA		8,344,387	5,176,285		128,283		3,039,839	
WYO	WIND RIVER	Arapahoe and Shoshone	1868	2,268,008	1,887,259	83 21	1,401	0 07	379,288	16 72
		TOTAL RESERVATIONS -- Billings Area		10,612,395	7,063,524		129,764		3,419,107	
MONT	TURTLE MT	Chippewa		87,378						
	Fort Peck				37,775	100 00				
	Fort Belknap				43,597	100 00				
	TOTAL - BILLINGS AREA			10,699,767	7,150,896		129,764		3,419,107	



Explanation

FEATURE	COMPLETED OR UNDER CONSTRUCTION	AUTHORIZED FOR CONSTRUCTION OR PROPOSED FOR DEVELOPMENT	POTENTIAL
FEDERAL DEVELOPMENTS			
Reservoir			
Canal			
Pumping Plant		NONE	
Hydroelectric Powerplant		NONE	
Transmission Line		NONE	NONE
Local Flood Protection			
Navigation Improvement		NONE	NONE
Migratory Bird Refuge		NONE	NONE
Fish Hatchery		NONE	NONE
SCS Project Area		NONE	NONE

BR = DEPARTMENT OF THE INTERIOR, BUREAU OF RECLAMATION
BP = DEPARTMENT OF THE INTERIOR, BONNEVILLE POWER ADMINISTRATION
CE = DEPARTMENT OF THE ARMY, CORPS OF ENGINEERS
SCS = DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE
BIA = DEPARTMENT OF THE INTERIOR, BUREAU OF INDIAN AFFAIRS

NON-FEDERAL DEVELOPMENTS			
Reservoir		NONE	NONE
Canal		NONE	NONE
Hydroelectric Powerplant		NONE	NONE

MONRC = MONTANA DEPARTMENT OF NATURAL RESOURCES & CONSERVATION

Irrigated Land — Irrigable Land

All Bureau of Reclamation developments labeled unit are in Pick-Sloan Missouri Basin Program

B I A POTENTIAL STORAGE SITES

1 Flathead River No. 1 (Knowles) site
2 Saint Marys Rivers No. 1
3 North Fork Cut Bank Creek No. 1
4 South Fork Cut Bank Creek No. 1
5 Badger Canyon No. 1
6 North Fork Milk River No. 1
7 Milk River No. 1
8 Greasewood Creek No. 1
9 Two Medicine
10 Spring Creek No. 1
11 Badger Creek No. 1
12 Rocky Coulee No. 2
13 Cut Bank Creek No. 1
14 Birch Creek No. 2
15 Box Elder Creek No. 1
16 Three Mile Creek No. 1
17 Peoples Creek No. 1
18 Porcupine Creek No. 2
19 Little Porcupine Creek No. 2
20 Wolf Creek No. 2
21 Tule Creek No. 2
22 Poplar River No. 3
23 Boxelder Creek No. 1
24 Poplar River No. 2
25 Smoke Creek No. 1
26 Prior Creek No. 1
27 East Fork Prior Creek No. 1
28 Woody Creek No. 1
29 Soap Creek No. 1
30 Rotten Grass Creek No. 1
31 Tutlock Creek No. 1
32 Owl Creek No. 1
33 Rosebud Creek No. 3
34 Cook Creek No. 1
35 Tongue River No. 3

MONTANA

WATER RESOURCE DEVELOPMENT

COMPILED BY
BUREAU OF RECLAMATION
UNITED STATES DEPARTMENT OF THE INTERIOR

1973

MAP No. X-600-192

SCALE OF MILES 20 0 20 40

GPO 833-882

Improvement in warning systems and in public education also enhance preparedness. Research into weather modification, with appropriate emphasis on possible adverse side effects should continue.

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SECTION IX

TORNADOS, WINDS, HAIL AND LIGHTNING

TORNADOS, WINDS, HAIL AND LIGHTNING

Tornados:

According to the National Weather Service reported tornados occur in Montana on an average of 4 per year. Many others occur which are not reported.

A summary of reported tornados from 1950 through 1975, by county, is as follows:

Big Horn	2	McCone	1
Carter	4	Petroleum	1
Cascade	3	Phillips	1
Chouteau	4	Powder River	5
Custer	3	Powell	1
Daniels	3	Prairie	2
Dawson	2	Ravalli	1
Fallon	2	Richland	4
Fergus	3	Roosevelt	4
Gallatin	1	Sheridan	1
Garfield	1	Sweet Grass	2
Granite	1	Teton	3
Hill	1	Valley	9
Judith Basin	2	Wibaux	2
Lewis & Clark	2	Yellowstone	7
		Total	79

The average of 3.04 reported tornados per year during the entire period compares with an average of 4 per year. This gives some indication of a recent increase in frequency. All except three tornados reported were east of

the Continental Divide with the greatest concentration in the eastern third of the State. Tornados occur most frequently during the months of June, July and August.

A review of fatalities dating back to 1916 shows (by decade) 1920-29 (2), 1940-49 (2) and 1950-59 (1) for a total of five. Three of these fatalities occurred in June and two in July.

History shows only five fatalities and a minimum amount of damage due to the fact that Montana is sparsely settled and no major tornados have touched down or passed through populated areas. Apparently there are no damage assessment records on tornados, probably because effects have been scattered throughout rural areas. It is evident, however, that should a tornado move through one of our cities or towns damage would be excessive. Very few people are tornado conscious to the extent that they have provided themselves with protection.

Hail:

The actual cost of damage caused by hailstorms in Montana is difficult to estimate due to the fact that individuals purchase insurance from many agents and companies and some are not insured at all. However, the State Board of Hail Insurance shows the following figures on the insurance they provided to farmers (crops only) for the years 1970 through 1975:

Year	Losses Filed	Losses Paid
1970	467	$ 296,766.84
1971	418	566,387.54
1972	471	380,439.22
1973	182	142,574.36
1974	578	804,895.40
1975	938	1,274,332.88

The National Weather Service has published a summary of hailstorms for the period from 1955 through 1967 which gives an indication of the number of storms and their severity. Hailstorms during this period totaled 264 with 177 storms generating hailstones from 3/4" to 1½" in diameter and 87 storms with hailstones of 1½" diameter and over.

The large majority of hailstorms are accompanied by high winds and lightning causing severe damage not only to crops, but to automobiles and buildings. The Weather Service reported Cascade County experienced a $2 million loss on October 8, 1944 and Chouteau County a $6 million loss on August 11, 1945. Yellowstone County and the City of Billings suffered a severe hailstorm July 6, 1955 with stones measuring to 3½" in diameter and high winds rendering extensive damage to homes, trees and shrubs, crops and livestock, businesses, public utilities and vehicles. Losses were recorded to upwards of $10 million. Again in early June 1958 the County and City of Billings were hit with resultant damage of near $5 million affecting the same catagories. Hailstorms in the spring of 1975 damaged hundreds of roofs in Helena. Again in 1976 Helena, as well as Butte and Great Falls, experienced destructive hailstorms. No accurate estimates of damage in these instances are available.

Winds:

No area in Montana has escaped high sustained winds from 70-80 miles per hour with damaging gusts at least 30% stronger. High winds occur more frequently East of the Continental Divide. Certain areas of the State such as Park and Glacier counties are particularly susceptible and it is often necessary to halt all vehicular traffic because of high winds. A 27 vehicle accident occurred on Interstate-90 on the southern perimeter of Livingston, Park County, Montana, attributed to inclement weather and

extremely high winds in November 1974. One life was lost with 7 persons injured. Rerouting of traffic to avoid that section of highway has become an established policy because of the frequency of these winds. In the Spring of 1976 one of two windstorms in Glacier County blew boxcars over from a moving train, overturned mobile homes, and severely damaged dwellings. The wind guage at the Burlington Northern Depot, in Browning, registered 100 m.p.h. with gusts up to 110-120 m.p.h. These winds are particularly hazardous during the winter months when they contribute to severe blizzards which isolate people, restrict travel, rupture power and telephone lines and kill livestock.

The National Weather Service records indicate 86 windstorms at 50-65 m.p.h. during the period from 1955 through 1967 in their Severe Weather Report. The largest majority of these windstorms occur during the months of June, July and August when vacation travel is at its peak.

Thunderstorms--Lightning:

For the most part the northern half of Montana has 20-30 thunderstorm days per year and the southern half has 30-40. An exception is that the southwest portion extending from approximately Helena west and south to the Idaho border and the entire Continental Divide area has from 40-50 thunderstorm days per year.

Lightning deaths over a period of years cannot be determined at the present time, but one person was killed at Valier in 1975 and one near Boulder in 1976. The National Weather Service statistics indicate lightning is the foremost killer (more than floods, hurricanes, etc.) in the United States. Lightning causes fires and physical damage to structures, livestock deaths and injuries, forest and range fires and disruption of power.

Of particular concern in Montana are livestock deaths, which are quite common, as well as forest and range fires which occur yearly on both a large and small scale from lightning source.

Research may some day lead to methods of reducing the severity of storms to acceptable levels. Meanwhile we are dependent upon increasing the accuracy of forecasting, the effectivenss of warning systems and the extent of insurance coverage. Emergency response plans should address these factors.

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Summary of Hailstroms 1955 through 1967, National Weather Service, National Oceanic and Atmospheric Administration.

SECTION X

TRANSPORTATION ACCIDENTS

TRANSPORTATION ACCIDENTS

Highway

Montana covers an area of 147,138 square miles and has a relatively small population of 694,409 according to the 1970 census. Interstate 15 running north and south from Idaho to the Canadian border is approximately 387 miles long. Interstate 90-94 running east and west from North Dakota to Idaho is approximately 658 miles long.

The map on page 89 shows the major highways within the state: I-15 (North to South), and I-90-94 (East to West), as well as U.S. numbered highways, state numbered highways and other numbered highways with comparatively heavy traffic. Every county in the state is subject to transportation accidents, but counties through which these major highways cross are most susceptable, especially since all roads except I-15 and I-90-94 are two lane traffic. I-15 has approximately 80 miles of two land traffic and I-90-94 approximately 125 miles.

U.S. #2 from the North Dakota border to the Idaho border is approximately 676 miles and is all two lane highway. This highway accommodates heavy traffic, especially during the summer months due to vacationers from the East coming to and returning from Glacier National Park and points west.

The same situation pertains in nearly all counties west of the Continental Divide as this is considered a summer recreational area. U.S. Highway 89 between Livingston and Yellowstone Park and U.S. Highway 191 between Belgrade and Yellowstone Park are heavily congested during the summer vacation periods.

The principal passenger bus line, Intermountain Transportation Company, operates on a three bus a day schedule (each way) both north and south and east and west and makes connections with smaller lines that pass through practically every county seat in the State. The Greyhoud Lines operate on

STATE OF

MONTANA

INTERSTATE, U S AND STATE NUMBERED RDADS

JAN 1, 1971

a three bus daily schedule each way over the entire length of Interstate 90-94. During the months of June, July and August this schedule is increased to four.

School buses operate five days a week on Interstate, primary, secondary, and rural routes during the school year which extends from September through May.

The Western part of the State, west of the Continental Divide, is a lumbering area and heavy loaded logging trucks create a traffic problem if not a definite hazard. They operate on Interstate, primary, and secondary highways in that area. The lumber industry is predominant in the forest area east of the divide, but to a lesser extent.

Severe winter storms and heavy snowfall affect all highways within the State requiring constant snow removal and keeping men and equipment on the alert.

Montana has some 28 mountain passes on its highway network. These passes are located in the western and southwestern mountainous part of the State and keeping the passes open for traffic is a 24 hour job during the winter months. With the winter driving conditions in Montana being treacherous at times because of black ice, snowpack, blizzards and etc. the probability of transportation accidents increases.

Railroad

Montana is served by the Burlington Northern Railroad, The Chicago, Milwaukee, St. Paul, and Pacific Railroad (Milwaukee Road), Union Pacific Railroad, and short, minor "stub" routes. These routes haul freight only and Amtrack provides the only passenger service.

Amtrack operates one train in each direction from east to west every day over the Southern Route through Glendive, Miles City, Billings, Butte,

and Missoula and another over the Northern Route through Glasgow, Havre, Shelby and Libby. These trains consist of 3 coach cars with a capacity of 40 seats each and 2 first class cars with a capacity of 30-40 accommodations each. Both routes enter Montana at the North Dakota border and exit at the Idaho border and vice versa.

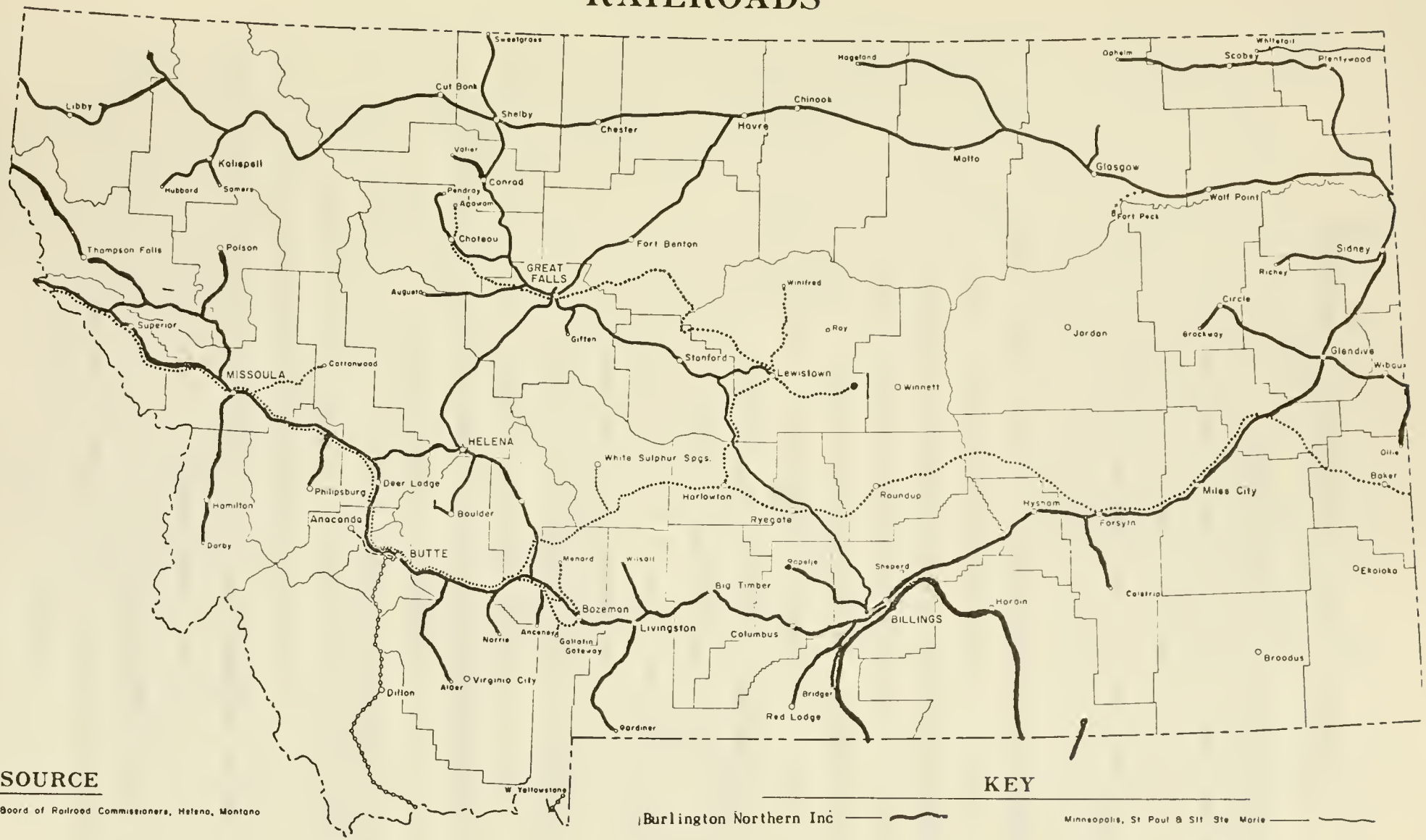
There have been two derailments of freight trains on the Burlington Northern route in the past three years. Had these been passenger trains there would have been an undetermined number of deaths and injuries among the 200 passengers which is the trains' capacity. Highway routes often do not follow the rail route which would pose a problem to police, fire, search and rescue units, ambulances and other emergency equipment. This problem would be compounded during the winter months because of snow and cold. Doctors and fully equipped hospitals are many miles from a possible scene of an accident. In any event there would be a shortage of doctors, hospital facilities, ambulances and possibly mortuary services.

The Burlington Northern has two major East-West routes through Montana. The Northern route traverses the State along the highline and basically parallels U.S. Highway #2. The Southern route parallels Interstate 94 from the North Dakota border to Billings then it parallels Interstate 90 to the Idaho border. There are two route running North-South through Great Falls connecting the Northern and Southern routes. The Burlington Northern is the largest railroad serving Montana.

The Milwaukee Road runs East-West and serves the central portion of the State and in many cases parallels the Burlington Northern Southern route.

The map on page 92, shows the railroads serving the State and the chart on page 93, lists the average daily traffic of the railroads.

RAILROADS



SOURCE

Board of Railroad Commissioners, Helena, Montana

KEY

Burlington Northern Inc

Chicago, Milwaukee, St Paul & Pacific

Union Pacific

Minneapolis, St Paul & Slt Ste Marie

Butte, Anaconda & Pacific

United States Government

White Sulphur Springs & Yellowstone Park

AVERAGE DAILY TRAFFIC OF RAILROADS SERVING MONTANA

Burlington Northern Average Daily Traffic:

Northern Route: 7-8 trains per day each way.
80-110 cars per train.

Great Falls-Havre: 1 train per day each way.
10-40 cars per train.

Great Falls-Shelby-Whitefish: 1 train per day each way.
10 to 20 cars per train.

Southern Route: 4-5 trains per day each way.
80 to 100 cars per train.

Laurel-South: 1 train per day each way.
10 to 40 cars per train.

Laurel-Glendive: 2 trains per day each way.
60 to 80 cars per train.

Great Falls-Helena-Butte: 1 train per day each way.
Number of cars varies greatly.

Coalstrip-east: 6-8 trains per day each way.
100 to 110 cars per train.

Sheridan, Wyoming-Hardin and east: 2-3 trains per day each way.
100 to 110 cars per train.

Milwaukee Average Daily Traffic:

North Dakota to Idaho border: 2-3 trains per day each way.
Averages about 250 cars per week each way.

Harlowton-Lewistown-Great Falls: 5 trains per week with number of cars vary considerably.

Union Pacific Average Daily Traffic:

Butte to Idaho Border: 1 train per day each way.
Number of cars vary considerably.

Air:

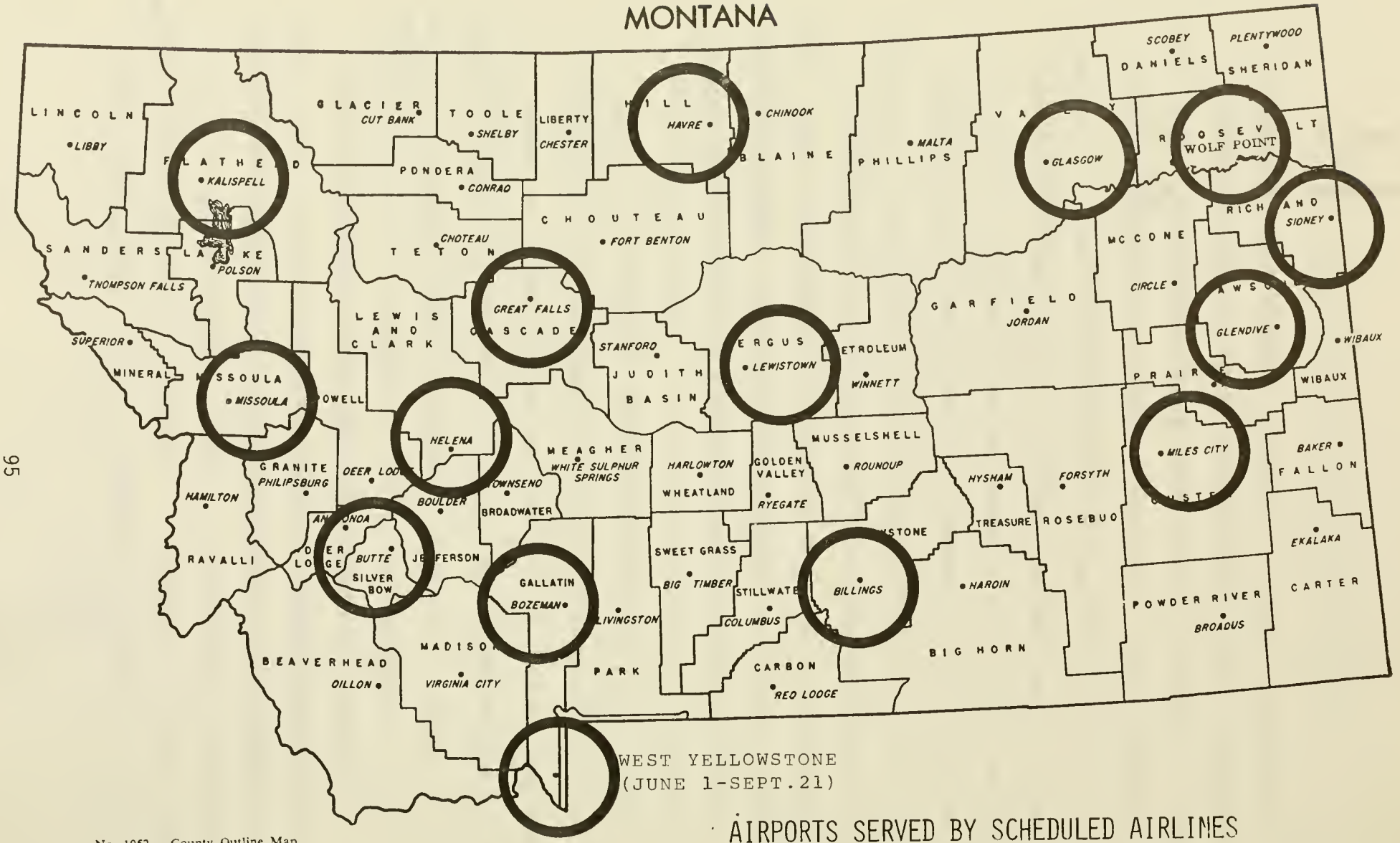
Experience has proven that nearly all commercial aircraft accidents and disasters occur at or near airports served by scheduled airlines, so there is less concern about the airports that serve general aviation. The map on page 95, indicates the airports served by scheduled airlines.

The airports in Billings and Great Falls are the largest in the State and handle the most traffic. Great Falls International Airport is the only airport with Customs in Montana and has an average of 25 flights in and out during a 24 hour period. The 120th Fighter Group, Montana Air National Guard also operates from this airport. Malmstrom Air Force Base, with an undetermined number of flights daily, is in close proximity (approximately 9 air miles) to the Great Falls International Airport. Also Great Falls serves as arrival and departure point for charter flights and is a frequent refueling and Customs stop for Air France Airlines enroute to Los Angeles.

Montana is served by four certified air carriers: (1) Frontier Airlines (2) Western Airlines (3) Northwest Airlines (4) Hughes Airwest Airlines. In addition there is Combs Airlines which handles strictly mail and makes night deliveries to Great Falls, Helena and Billings. Figure 1 on page 96, indicates the number of scheduled flights by certified air carriers to Montana cities in 24 hour period.

In the event of a serious accident or crash at any major airport or other location, the communities resources would be extremely taxed. Because it would depend on the number of passengers and seriousness of the accident and would most likely involve fire, police, ambulance service, doctors, nurses and medical technicians. A larger city such as Great Falls or Billings would have less difficulty in providing equipment, services and personnel

MONTANA



AIRPORTS SERVED BY SCHEDULED AIRLINES
(SEE FIGURE 1 ON FOLLOWING PAGE)

No. 1052 — County Outline Map
STATE PUBLISHING COMPANY
Helena

Number of Scheduled Flights

By Certified Air Carriers

To Montana Cities in 24 Hour Period

City	Northwest	Western	Frontier	Hughes Airwest	Total
Great Falls	6	10	2	1	19
Billings	13	5	13	---	31
Helena	3	2	---	---	5
Butte	5	4	---	---	9
Bozeman	6	---	4	---	10
Missoula	6	---	3	---	9
Kalispell	---	---	2	2	4
Havre	---	---	1	---	1
Glasgow	---	---	4	---	4
Wolf Point	---	---	2	---	2
Glendive	---	---	2	---	2
Miles City	---	---	2	---	2
Lewistown	---	---	1	---	1
Sidney	---	---	2	---	2
West Yellowstone*	---	4	---	---	4

June 1 thru September 21 only

Figure 1.

than the smaller cities with major airports such as Kalispell or Wolf Point where they do not have such a pool of resources and personnel.

In summary transportation accidents can cover several types of accidents. Some examples might include: a loaded school bus sliding off a icy road and rolling over, a tank truck hauling gasoline being involved in a head-on crash and spilling gas which in turn catches fire, a passenger train derailing and causing serious injuries to the passengers, a commercial airline crashing and killing all the crew and passengers or a freight truck hauling dynamite involved in a wreck catches fire and explodes. In all of these examples the response of emergency medical personel, police, fire and search and rescue teams is important. Continued training at the State and local level of emergency response personel is essential and continued studies on the causes of the various accidents by State and Federal agencies is needed.

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SECTION XI

VECTOR

VECTOR

A number of vector-borne diseases may be found in Montana. These include: Western Equine Encephalitis, St. Louis Encephalitis, Colorado Tick Fever, Rocky Mountain Spotted Fever, Tularemia, rabies and Leptospirosis. Other "food-borne diseases" may also be spread by vectors.

The most commonly occurring of the vector-borne diseases are (1) Colorado Tick Fever, (2) Western Equine Encephalitis, and (3) St. Louis Encephalitis

(1) Colorado Tick Fever: Owing to the predominantly mild reactions to Colorado Tick Fever and its self-limited nature, relatively few cases are reported. In a 3 year study period, (July 1970 to July 1973) there were 32 cases reported in the state. Twenty-nine of the reportings were in the western mountainous region of the state. However, the Montana Department of Health and Environmental Sciences has indicated that as many as 200 cases of Colorado Tick Fever occur annually with very few being reported. Colorado Tick Fever is transferred to man by the Rocky Mountain wood tick and may develop into a form of encephalitis in children.

(2) Western Equine Encephalitis: The mosquito culex tarsalis transmits Western Equine Encephalitis from birds to man or horses. An ancillary cycle involving jackrabbits and flood or pasture land "pest" mosquitoes also occurs. The number of cases of Western Equine Encephalitis varies from year to year. Cool, wet springs and floods are major contributing factors to increased incidence. With high populations of culex tarsalis, mosquito transmission of Western Equine Encephalitis from birds to man or horse becomes more likely. This ancillary cycle has an indirect affect on encephalitis activity, in that, it acts to amplify the virus in the host bird populations. Incidence is typically higher in irrigated areas east of the Continental Divide. Between

7% and 13% of the adult population that participated in health screening clinics in the Milk River Valley between 1969 and 1973 reacted positively to Western Equine Encephalitis activity has been noted in Flathead, Lake, Missoula, and Beaverhead counties during the past five years. However, in Lake, Missoula, and Ravalli counties only 2% to 4% of the adult population sampled reacted to antibody tests.

Western Equine Encephalitis is typically a fairly mild disease in man, severe in horses. It is characterized by severe headaches, fevers and loss of equilibrium. Its mortality rate is approximately 2%. Convulsions occur in a high proportion of infants less than one year old and in about 40% of the patients from 1 to 4 years of age. In adults, mental confusion is common and sleep or coma occurs in about 35% to 40% of the patients. A serious aftereffect is that a significant proportion of infants appear to recover and then suffer brain damage to the extent that they require institutionalization.

(3) St. Louis Encephalitis: The primary disease vector of St. Louis Encephalitis in Montana is Culex tarsalis, mosquito. In some areas, St. Louis Encephalitis outbreaks appear to be favored by heavy spring rains followed by hot, dry summers. Again, floods amplify the possibility of St. Louis Encephalitis outbreaks. For reasons not understood, clinical expression of St. Louis Encephalitis in Montana has been fairly low. However, health screening clinics indicate that more individuals in the higher mountainous areas have reacted to St. Louis Encephalitis antibodies that Western Equine Encephalitis antibodies.

Although the primary vector of St. Louis Encephalitis is the same as with Western Equine Encephalitis, the distribution of disease potential

does not parallel that of Western Equine Encephalitis. In the Milk River health screening clinic, St. Louis Encephalitis antibody reactions occurred in from 1% to 4% of the adults surveyed (versus 7% to 13% for Western Equine Encephalitis) while in Lake, Ravalli, Jefferson, Broadwater and Carbon counties, the percent antibody reaction to St. Louis Encephalitis was between 6% and 13% (while Western Equine Encephalitis reactions were from 2% to 5%). Thus, St. Louis Encephalitis appears to be more significant for counties in western and south central Montana. Clinical symptoms of St. Louis Encephalitis generally parallel those of Western Equine Encephalitis. However, St. Louis Encephalitis has a higher mortality rate which varies from 5% to 30% with mortality rates being highest in the elderly.

In June 1975, Montana experienced severe flooding which effected several counties. Following the flood extremely heavy "pest" mosquito populations were evident through the flood stricken counties. Fourteen (14) counties were declared major disaster areas by the President and four (4) of the fourteen (14) counties declared received federal disaster funding for Vector Control because of the potential outbreak of Western Equine Encephalitis or St. Louis Encephalitis.

The counties which received federal disaster assistance for Vector Control and the amount they were approved for is as follows:

Cascade	$32,861
Lewis & Clark	6,483
Jefferson	1,618
Flathead	572
Total	$41,534

Montana law allows cities and counties to form mosquito control districts

to control mosquitoes. In 1975 there were 24 mosquito districts formed in Montana. It is recommended that the existing districts keep extensive records on (1) pesticides used (2) acres controlled (3) types of mosquitoes and (4) costs. Areas in the state that have mosquito problems should form districts for control purposes.

Additional studies should be undertaken in the control of Rocky Mountain wood tick.

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SECTION XII

WINTER STORMS

WINTER STORMS

Geographically Montana is located in a winter belt and can anticipate severe winter conditions annually. According to the National Weather Service, Montana suffers "severe winter storms on an average of once or twice a year". Such storms are usually characterized by extremely low temperatures over an extended period, strong winds, drifted and crusted snow and ice-bound streams and bodies of water. At other times, while temperatures remain moderate, wet snow is deposited in such volume as to curtail normal activity.

When these extreme conditions prevail communities can be cut off from outside contacts for several days. Danger of isolation of large rural areas by heavy snows is a constant concern involving loss of power and communications, blocking of roads to schools, hospitals, and stores. It is not unusual for deep snows to block roads into the small community of Babb, Glacier County, necessitating delivery of food supplies by air or snowmobile. The situation in Babb is not unique since other towns at high altitudes or exposed to strong, snow-laden winds are subject to isolation by extensive drifts.

Sickness and injury become more serious problems in these situations when the services of hospitals are unavailable. Stocks of food, drugs, fuel and other essential supplies are soon exhausted. Productive activity is at a standstill as all energy is directed toward the recovery effort. County road crews assume responsibility for clearing miles of unimproved roads under conditions of isolation and great exposure. Few snow plows are equipped with two-way radios for emergencies.

Transportation during winter storms is especially hazardous. Movement of students by bus to and from schools under blizzard conditions can be

accomplished only at considerable risk. The potential is evident when the critical factors are considered, such as total students transported daily, total miles traveled and communications equipment available in case of emergency. The following statistics from counties representative of rural Montana indicate the extent to which most communities are vulnerable:

Big Horn--20 buses, 1000 to 1500 students. Some routes 100 miles round trip. Radio in one bus.

Musselshell and Golden Valley--450 to 500 students. One route 138 miles round trip. Radio in one bus.

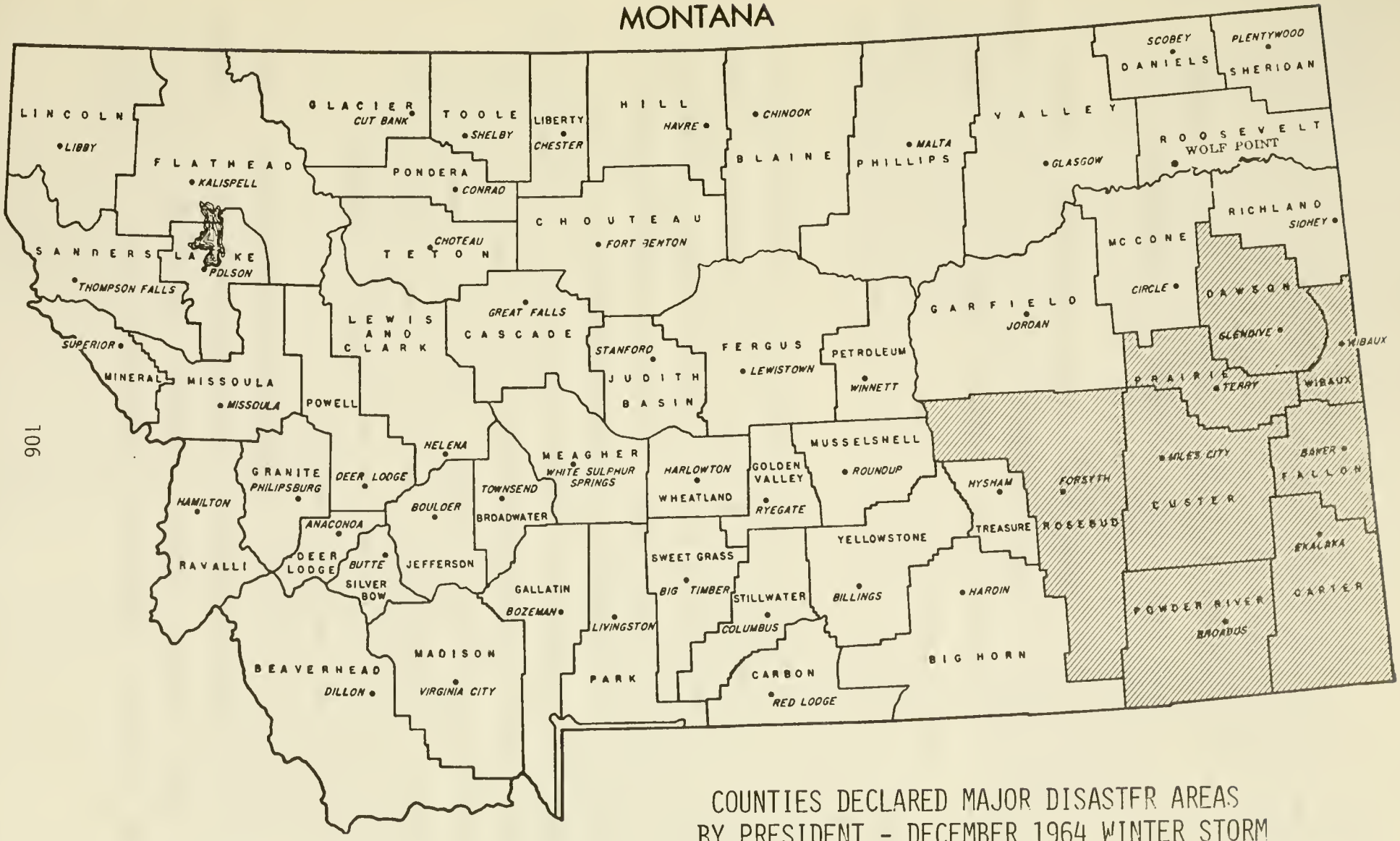
Stillwater--approximately 350 students. 100 mile round trip for one bus. Radio in one bus.

Wheatland--80-100 students. Routes of 150 miles. No radios in buses.

To preclude the possibility of sending children out when severe conditions are imminent, local emergency plans, including school plans, are keyed to the nearest weather service. Storms occurring during the school day or without warning, however, remain a constant threat.

In addition to "people" problems winter storms can cause considerable economic loss, especially in the livestock and lumber industries. Emergency deliveries of hay and supplemental feed crops have been necessary in storms recorded in 1948-49, 1964-65, 1972-73 and 1974-75. These storms also required a number of other resources to be used such as bulldozers, road patrols, emergency generators, emergency communications, mobile medical assistance and others. The 1964-65 storm as an example became a Presidentially declared disaster identified as OEP-182-DR-Montana December 18, 1964. Eight counties in the eastern portion of the State--Dawson, Prairie, Wibaux, Fallon, Custer, Rosebud, Powder River and Carter Counties, as well as the

MONTANA



COUNTIES DECLARED MAJOR DISASTER AREAS BY PRESIDENT - DECEMBER 1964 WINTER STORM

OEP-182-DR

No. 1052 — County Outline Map
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State itself, received federal aid. Hard crusted snow over pasture lands prevented stock from foraging and created complete dependence on hay or commercial feed. Most ranches could not reach their stacks or, if feed supplies were attainable it was seldom possible to deliver an adequate amount to stranded stock. Frozen reservoirs and tanks compounded the difficulties.

There are some indications that, in most winters, the severe storms are arriving later in the year than was the case four of five decades ago. Regardless of the validity of this observation late storms which coincide with the calving and lambing season result in greater risk to the livestock industry. Feed supplies also suffer since pastures have been grazed down for the most part.

Surveys have been conducted in some counties to determine stocks of food and other emergency items available in rural communities. Findings indicate some persons would be safe for several days and a few would be self-sufficient for several weeks. In other cases supplies would be exhausted in a very short time. Farm and ranch dwellers and rural communities have been urged to emphasize preparedness by keeping more food on hand, procuring some type of emergency power to operate refrigeration and locker plants--private and public, establish radio communications to augment land line facilities, maintain large fuel supplies and cattle feed and stock special equipment and medical supplies which might be unobtainable under emergency conditions.

Although county authorities readily agree on the advantages of more and better equipment, such as rotary snowplows and communications, funding will remain a problem. Frequently snow removal costs exhaust county road funds. Provision of some form of relief for this annual problem deserves

consideration.

Some recommended preparedness measures can be implemented with very little impact on the budget--improvement in warning procedures, participation in training exercises and procurement of excess military vehicles for conversion for emergency use are suggested.

The winter survival portion of the Civil Defense school course, "Your Chance to Live" is applicable as are survival training sessions conducted by search and rescue units and similar organizations. Full appreciation of the potential of severe winter storms is a first step in combatting effects and conducting recovery efforts.

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